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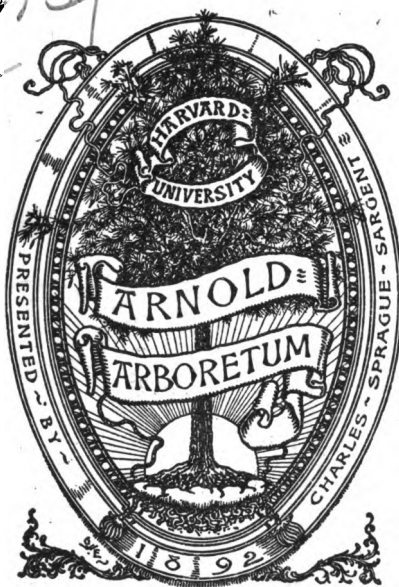
Annual report

Massachusetts. State Forester

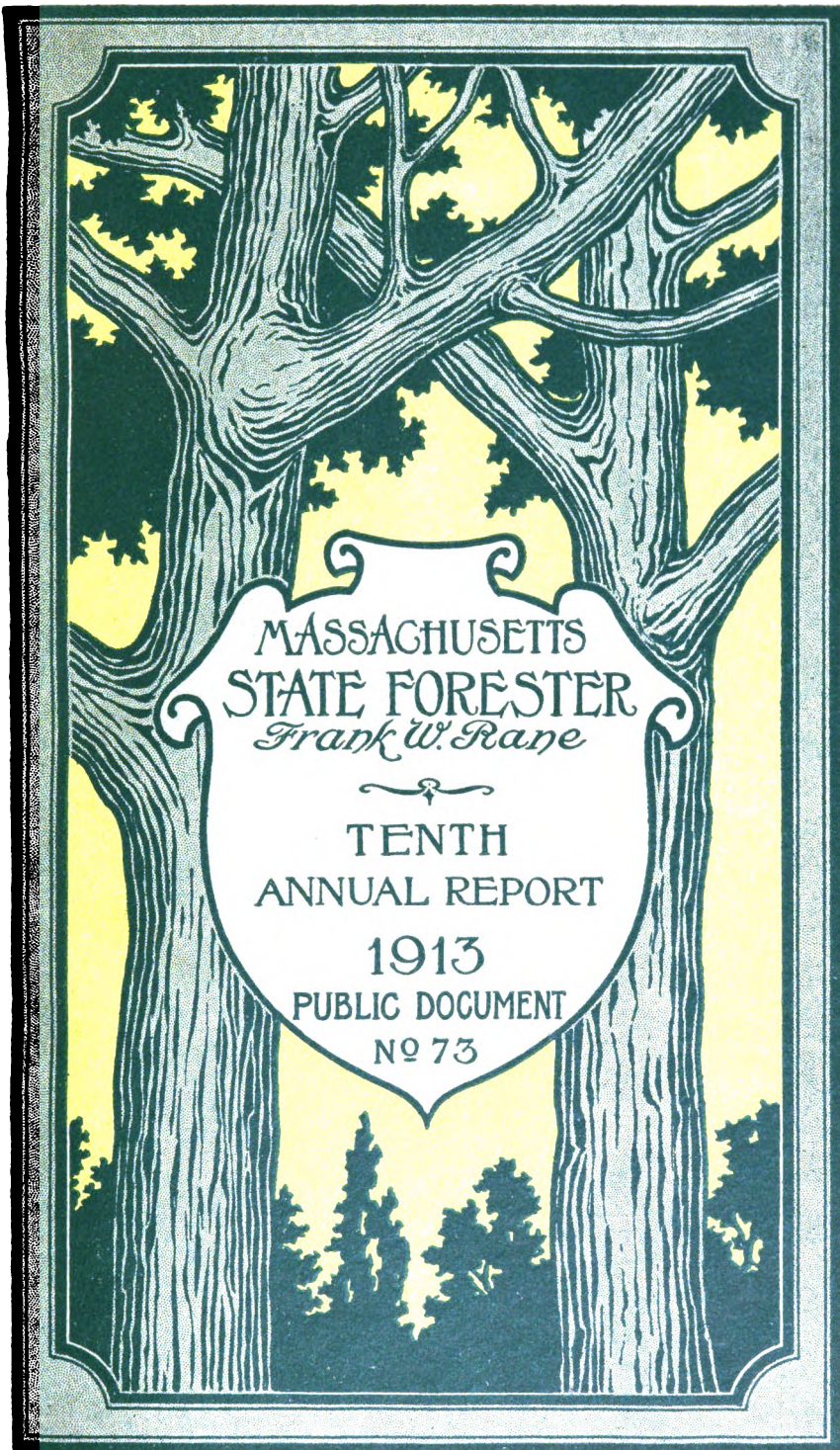


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THE
STATE FORESTER
OF
MASSACHUSETTS.

TENTH ANNUAL REPORT,
1913.

F. W. RANE, STATE FORESTER.



BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
32 DERNE STREET.
1914.

31336

APPROVED BY
THE STATE BOARD OF PUBLICATION.

The Commonwealth of Massachusetts.

To the General Court.

I herewith am pleased to present this the tenth annual report of the State Forester, which designates the activities of the department throughout the year, together with recommendations for the future.

The gypsy and brown-tail moth work, which this department has been able to reduce \$115,000 a year, compared with 1911, has amalgamated nicely into the State Forester's department and is herein reported upon. The present general outlook for this work is more promising than ever.

This report is submitted in accordance with the provisions of chapter 409, section 5, Acts of 1904.

Respectfully submitted,

F. W. RANE,

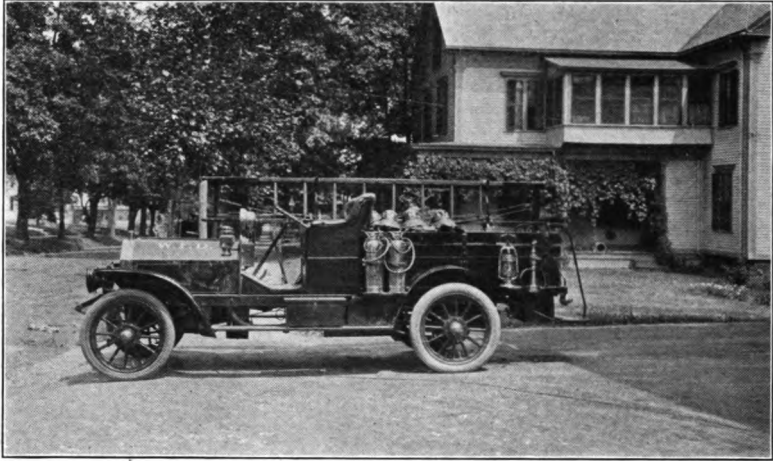
State Forester.

DEC. 20, 1913.

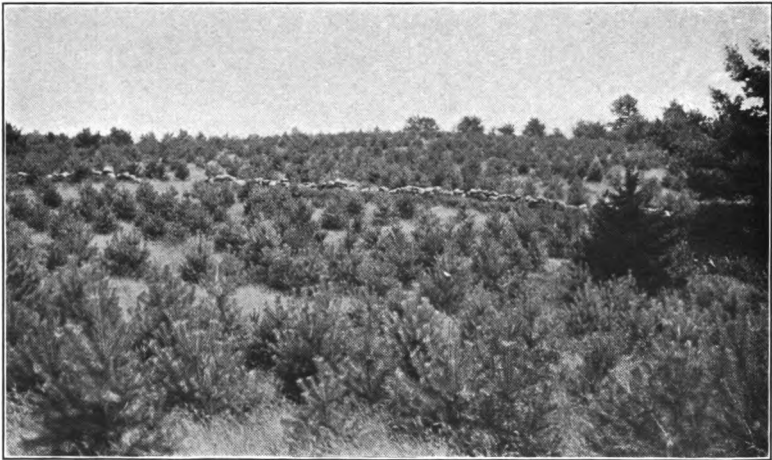
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The town of Winchendon forest fire auto truck. Has carried ten men and necessary equipment. It is also used as an auxiliary hose truck for house fires. By an ingenious arrangement the hose-reel and box containing hand extinguishers are quickly interchangeable, and hence the truck serves a double purpose. Cost of truck, \$1,000.



A four-year plantation of Scotch pine, planted by the Murdock Company of Winchendon. The whole farm was purchased for the value of its wood growth, and the run-out fields, as here shown, have been planted. This farm is located in Ashburnham. A good example of what the Winchendon manufacturers are doing. They also plant cut-over lands in the same way.

The Commonwealth of Massachusetts.

TENTH ANNUAL REPORT OF THE STATE FORESTER.

INTRODUCTION.

With this report the office of State Forester completes the first decade of its existence. It is a pleasure at this time not only to report upon the activities and accomplishments of the year just closing, but to also call brief attention to our ten years of sturdy growth and our increasing usefulness to this grand old Bay State, whose natural resources we are striving to protect and augment. The people of Massachusetts are second to none in public sentiment, and now that forestry is definitely recognized as of fundamental importance to both our economic and æsthetic development, in what direction, may I ask, should our efforts toward usefulness tend during the next ten years?

Let us all have a hand in this most promising and captivating work, and I am sure that future decades as they roll by will each point to the earnest beginning of this generation.

If our interest in the work maintains its steady growth throughout the State, the next ten years will accomplish far more than most people realize, and hence even we, ourselves, may live to enjoy some of the first fruits of our labors.

It is proverbial that we Americans are rather deliberate and desire to get our bearings before we really set ourselves to a task, but once satisfied we are right, then we break all precedent in our ability to accomplish results. What Germany, Austria, France, Denmark, Belgium and other countries have taken centuries to learn, we can quickly adopt and put into practice. To allow 1,000,000 acres of depleted and waste lands to lie idle in a live and progressive State like Massachusetts, where the

markets are the best in the world, is accounted for only by the fact that forest products, like all other natural resources, have been cheap in the immediate past, it being necessary only to harvest the crop. From now on we shall find it necessary to plant and grow the crop to secure us a harvest.

Besides the 1,000,000 acres of so-called waste land capable of reforestation, it is estimated that there are 2,000,000 more in forests of varying conditions, one-half of which, it is safe to say, comprising sprout or scrub growth of little financial value, while the remainder is in merchantable condition.

This office has made sufficient study of the growth of white pine alone to show that, at present prices even, we might in the future, under modern forestry practices, cut lumber annually that would yield millions of dollars to this Commonwealth.

Most of our people think that Massachusetts is so depleted and cut over from a forestry standpoint that we are in a very humiliating position, and they are right; and yet our scattered remnants of forests continue to supply trees enough to keep 300 saw mills, mostly of the portable type, busily engaged every day throughout the year in some section of the State. The lumber produced in the State to-day, therefore, is a very great asset, probably approximately 500,000,000 feet, board measure, and representing an annual investment of \$15,000,000 and a net profit of from \$2,500,000 to \$7,500,000 to our people.

It is estimated that we grow only 5 per cent. of the forest products used in the State. Massachusetts is a busy and bustling manufacturing center, and her demands for lumber and other forest products are no small matter. A bulletin — the first of its kind to be published in this country — has been issued by the State Forester and contains a list of our various wood-using industries, their location throughout the State, the kinds of forest products used, the finished product and other very interesting information. At the present time we are drawing on Washington and Oregon at almost prohibitive prices for our better soft woods, and from the Carolinas and Tennessee for our hard woods; but may we pause to ask where shall our mill owners turn next, once these virgin sources are depleted. Surely, we must feather our nest now while we can depend upon the outside supply, so that when this begins to ebb we may be able to turn to our own home-grown products.

It costs \$20 or more a thousand to ship lumber from the Pacific Coast to us, and we can plant, grow, harvest and make a profit right here at home for this expenditure.

As State Forester, I desire to see our people enthused on such a broad and comprehensive scale in reforestation and the practice of modern forestry methods as to make this old Bay State a veritable forest park from the tip of Cape Ann to the town of Mount Washington, and from the summit of Greylock Mountain to Provincetown and our islands in the sea. Let the slogan, "Boost forestry!" prevail everywhere.

Our lumbermen without exception are everywhere practicing more economic methods, especially upon the properties owned by them; boards of trade and merchant associations are recognizing the importance of better forestry as a great future asset to their respective sections, while clubs and other organizations are surely no less interested.

The Massachusetts State Forestry Association, which has a permanent paid secretary who gives his whole time to the work of the association, has found more real interest in forests and trees on the part of our people generally throughout the past year than has been shown heretofore. The membership alone, which is entirely voluntary, is indicative of the present interest, having increased from 1,800 to 3,200. The membership was only 800 three years ago. It is needless to point out that this association has been and is of valued assistance to the State Forester; in fact, it was this organization that labored so diligently for forestry in the decades before this office was created.

The State Board of Agriculture, backed by its strong constituency of agricultural societies, which represent the rural industries of most of our stalwart farming sections, is also showing splendid interest in forestry.

The Massachusetts State Grange, our own order of Patrons of Husbandry, which is recognized in every rural community in Massachusetts as life-giving and comprising a social center, has been of great help to this department as a medium for getting into personal touch with landowners interested in our work. It was the enthusiastic support of the State Grange, I am frank to say, that aided as much as any one factor in the enactment of our present and most efficient forest fire permit law.

The Federation of Woman's Clubs, it is needless to point out, has ever been in the front rank in promoting better forestry.

So I might continue to elaborate upon the good will and assistance of organizations and associations which are aiding the State Forester in his work; but suffice it to say that we appreciate their co-operation and trust in its continuance. We feel sure of this continued co-operation, since our cause is so worthy and so dear to the hearts of all of us.

ACTIVITIES OF THE DEPARTMENT.

The work that was so fully outlined in the introduction of last year's report I refrain from again reviewing here. While we thought our activities were many and effective at that time we are frank to confess that during the past twelve months the work has increased, both in new directions and in the enlargement of old methods. The number of observation or look-out stations for forest fires was increased from 18 to 21, and the State Fire Warden's work strengthened in every way. The inspection of railroad locomotives has been conducted for the first time by our own men, which co-operation has resulted in far better service, in improved spark arresters and ash pans.

The chestnut blight work was greatly augmented by our being able, through the continued co-operation with the United States Department of Agriculture, to secure the services of Mr. Roy G. Pierce, a graduate in forestry who had been in the employ of the Pennsylvania Chestnut Blight Commission until that work was discontinued. Mr. Pierce has entered heartily into the State Forester's plans, and it is believed that our activities have been recognized in every section where the chestnut grows. A report on chestnut blight published elsewhere will be of interest.

The activities in the moth work have been fully as encouraging as any phase of the State Forester's undertakings. Notwithstanding the fact that we are spending \$115,000 less than we were two years ago, the work has gone on with equal efficiency. We have studied carefully the conditions of each city and town, and our efforts, due to more experience on the part of both State and local officials, have resulted in far greater efficiency and economy.

The introduction of silvicultural methods and better forestry practices has made the outlook in moth suppression more encouraging than at any previous time. Step by step, each year seems to give us a new vantage point in the moth work, and while it is conceded by all experts that our problem is now one of suppression and not extermination, we in this State are prepared to handle the problem in the most rational and economic way. The moth work in our cities and towns is resolving itself down to a definite business undertaking in which each is lessening its expenditures in proportion to the thoroughness with which the work is done each year. Towns and cities alive and active are beginning already to look with relatively little concern on the problem, especially throughout their residential sections. Woodlands are also being properly managed by this department as regards the gypsy and brown-tail moths, and with a greater degree of success than ever.

During the stripping stage of the gypsy moth this year we notified all the division superintendents to list all forest properties within their respective territories thus affected, and to report the names of the owners, the location of the tracts and the number of acres stripped. Upon receipt of these data a notice was sent each landowner in which the services of a trained forester were offered, at no expense, to meet the said owner and advise him, on the ground, as to the best methods of management to pursue. The only condition on the part of the owner was that he sign and return the request and plan to carry out the meeting. This work is the continuation of that alluded to under the heading, "Better Forestry the Solution of the Moth Problem," in last year's report.

The scheme has worked out marvelously, and over 300 requests have been received for examinations and advice, and they are still coming in. Mr. Paul Kneeland, who succeeded Mr. H. F. Gould, the latter resigning to go into private forestry work, has organized and carried out this work with the aid of Mr. Smith and certain of the division superintendents, until at the present time he has examined 10,000 acres. Already forestry operations have resulted in actually carrying out the work on 1,000 acres. At the present time, organized operations in improvement cuttings are being practiced in 12 different

places. The results of this work, together with more detailed information as to cost, etc., will be given elsewhere in this report.

The parasite work has already begun to show very good results, as must be evidenced by all casual observers. Particularly is this true in the case of the imported calosoma beetle which, in both the adult or beetle and the larval stages, was extremely numerous this past year. In neglected woodlands, where the moths were bad, the writer is of the opinion that the calosoma destroyed at least one-tenth of the moths present. Other parasites are reported upon elsewhere by Dr. L. O. Howard, United States Entomologist, who has co-operated with us.

Of the mechanical methods of suppression, spraying with arsenate of lead is still one of the great factors in our hands for ameliorating conditions. Several more towns have added high-power spraying machines during the year.

Approximately 750 tons of arsenate of lead were used throughout the season. The Metropolitan Water and Sewerage Board purchased an auto truck sprayer the past season, which makes the third now in use.

The plans for enlarging the output from our nurseries, through utilizing the labor of some of our State penal institutions, are very promising indeed. Three acres of transplant stock were set out on land turned over to the State Forester for this purpose on the land of the State Farm at Bridgewater this fall, and Captain Blackstone, the superintendent of the institution, has promised us enough more land to make 10 acres in all by next spring.

The Foxborough State Hospital is also preparing a plot for a nursery on a very conspicuous site along the State highway at Norfolk, and it is believed this institution, through its being able to co-operate in aiding the State in the work of reforestation, can render splendid service to the State. Dr. Neff, the superintendent, and the board of trustees are all very enthusiastic over the undertaking. The State Forester's nursery at Amherst is as great a success as ever, and our total capacity is estimated at about 7,000,000 seedlings and transplants at the present time. We have donated several hundred

thousand to various State institutions, as the nursery report will show. This is printed elsewhere in the report.

The last General Court created, and Governor Foss appointed, a commission on the taxation of waste and forest lands. This commission has been arduously at work holding hearings throughout the State and making a study of the subject during the summer and fall. These deliberations will be incorporated into a bill to be submitted to the incoming Legislature for its approval. I am sure we all will welcome a more wholesome and definitely regulated system of taxation, to encourage the practice of modern forestry in the State.

Our present method of leaving slash after lumbering operations continues to be one of our greatest menaces, and results in constant loss and damages to forest property owners. In talking with some of our best lumbermen it is generally agreed that if we were to require that the slash be disposed of, it would do more for future forestry possibilities in the State than any other one thing. Our really great forest-fire losses are inevitably caused, not by the average fire that is found in the woods, but from the fact that these fires occasionally reach large bodies of slash where they get the momentum that becomes uncontrollable. The time is bound to come when this slash menace must be regulated. Why not give it due consideration at the present time?

It is believed that the time is ripe for the State to enlarge upon its forest policy to the extent of establishing State forests. The work under our reforestation act has been a pronounced success and very useful as a beginning, but we need a much more pretentious undertaking to do justice to the needs of the State. Massachusetts surely can afford as extensive a policy as many other States are practicing. With our present outlook in utilizing the State institutions for growing our small trees cheaply, we could reforest and manage large tracts of present worthless or waste lands in a practical and economic way. I would respectfully urge the incoming Legislature to give this subject due consideration.

ORGANIZATION.

It has been my purpose to have the organization of the State Forester's department composed of loyal, wide awake, enthusiastic, experienced men.

A clear-cut organization, in which each official not only has a definite field of usefulness but is alert and full of enthusiastic interest, is absolutely necessary to success at our present stage of forestry development. We now have a corps of men familiar with tree and forest conditions throughout the State. The various divisions of the department are in charge of trained men; foresters for the most part, but a few so-called practical men, have been developed, there being no trained foresters of experience and efficiency available. The State policy is to utilize the whole organization in the bettering of our forestry conditions, and while each employee has his definite routine of duty to perform, he at the same time intuitively assists in the control of all forest depredations, such as fires, insects and diseases. While our men are not all experts in entomology or mycology, nevertheless they are familiar with the fundamentals in these sciences, and expert enough to observe new and extraordinary conditions. Where experts are needed they are delegated to direct the task, but they in turn utilize the State Forester's general organization as auxiliary in the work.

The splendid organization of forest wardens and moth superintendents, one in each town and city, forms an army of public-spirited men who become more efficient each year, and therefore of greater value to the community. There are 353 forest wardens, with over 1,000 deputies, and 282 moth superintendents throughout the State.

There were a few changes in the staff of assistants the past year, as is inevitable each year.

Mr. H. F. Gould, who had been an assistant for several years in forestry management, resigned to engage in forestry work as general manager of the Franklin Forestry Company. It was with reluctance that we parted with his services, as his work was certainly appreciated and of a high order. Mr. Gould had been placed in charge of the work of forestry management as applied to moth control, and he very kindly remained with us several weeks after the term of his resignation, in order that

his successor, Mr. Paul D. Kneeland, could get the work sufficiently in hand. This was highly appreciated by the State Forester.

Mr. Paul D. Kneeland, who succeeded Mr. Gould, is a graduate of the Harvard Forestry School, and has had experience in the United States Forest Service in the west, and has been in the employ of Fisher, Bryant & Olmstead of Boston, foresters.

Miss Charlotte Jacobs, who was the State Forester's only assistant and stenographer when he first came to his present position in the State, resigned last spring after seven years' faithful service. Her regularity, thoroughness and enthusiastic interest in the work of the department are missed.

The office of inspector in the moth work has been discontinued, this going into effect on August 1 last. The office of local moth superintendent has so increased in efficiency that it was found unnecessary to incur this extra expense longer.

The remainder of the organization remains practically intact, the work being shifted more or less to suit our greatest needs.

The organization at present is as follows:—

GENERAL STAFF.

F. W. RANE, B.Agt., M.S., .	. State Forester.
H. O. COOK, M.F., .	. Assistant Forester.
M. C. HUTCHINS, .	. State Fire Warden.
GEORGE A. SMITH, .	. Assistant, moth work.
R. S. LANGDELL, .	. Assistant, reforestation.
PAUL D. KNEELAND, M.F.,	. Assistant moth work.
W. D. CLARK, M.F., .	. Assistant, Massachusetts Agricultural College.
ROY G. PIERCE, M.F., .	. Assistant, chestnut blight work.
FRANK L. HAYNES, B.F., .	. Assistant, forestry management.
JOHN MURDOCH, Jr., M.F., .	. Assistant, moth work.
CHARLES O. BAILEY, .	. Secretary.
ELIZABETH HUBBARD, .	. Bookkeeper.
ELIZABETH T. HARRAGHY, .	. Stenographer.
JOSEPHA L. GALLAGHER, .	. Clerk.
FRANK GARBARINO, .	. Office boy.

STAFF, FOREST FIRE PREVENTION.

F. W. RANE, .	. State Forester.
MAXWELL C. HUTCHINS, .	. State Fire Warden.
MINER E. FENN, .	. Assistant.
JAMES E. MOLOY, .	. Locomotive inspector.
OSCAR L. NOYES, .	. District Forest Warden No. 1.
J. J. SHEPHERD, .	. District Forest Warden No. 2.
JOHN P. CROWE, .	. District Forest Warden No. 3.
ALBERT R. ORDWAY, .	. District Forest Warden No. 4.

*Observers and Observation Stations.**District 1: —*

WM. BRAY,	Bald Pate Hill, Georgetown.
M. L. CARPENTER,	Moose Hill, Sharon.
HENRY FAY,	Hart Hill, Wakefield.
J. FRANK HAMMOND,	Robbins Hill, Chelmsford.
ELLIOT C. HARRINGTON,	Blue Hill, Milton.
CAPLIS MCCORMICK,	Morse Hill, Essex.

District 2: —

CALVIN BENSON,	Shoot Flying Hill, Barnstable.
FRANK L. BUCKINGHAM,	Reservoir Hill, Plymouth.
WALTER L. EAMES,	Richmond Hill, Dighton.
S. MATTHEWS,	Middleborough.
CUSHING O. THOMAS,	Bonney Hill, North Hanson.

District 3: —

A. M. BENNETT,	Lincoln Mountain, Pelham.
W. J. HALLORAN,	Fay Mountain, Westborough.
F. H. LOMBARD,	Grace Mountain, Warwick.
JAMES MALEY,	Wachusett Mountain, Princeton.
HAROLD MCKINSTRY,	Little Muggett Hill, Charlton.
GEORGE W. SHERMAN,	Steerage Rock Mountain, Brimfield.

District 4: —

CLAUDE E. G. CAIN,	Tower Mountain, Savoy.
JAMES S. ROSE,	Becket Mountain, Becket.
GEO. C. MILLER,	Mount Tom, Easthampton.
NELSON C. WOODWARD,	Massaemet Mountain, Shelburne.

STAFF, MOTH WORK.

F. W. RANE,	State Forester.
GEORGE A. SMITH,	Assistant.
PAUL D. KNEELAND, Assistant, forestry moth work.	
JOHN MURDOCH, Jr., Assistant, forestry moth work.	
FRANCIS V. LEAROYD, in charge of supply store.	
FREDERICK P. HALPIN and CLAUDE E. TOWLE, Mechanics.	
JOHN F. LANERGAN, Assistant at supply store.	
JOHN W. ENWRIGHT, District 1, 299 Fellsway, Medford.	
SAUL PHILLIPS, District 2, Box 266, Beverly.	
JOHN J. FITZGERALD, District 3, 50 Howard Street, Haverhill.	
WILLIAM A. HATCH, District 4, Lakeside Ave., Marlborough.	
HARRY B. RAMSEY, District 5, 27 Duxbury Road, Worcester.	
CLARENCE W. PARKHURST, District 6, Box 472, Medfield.	
WALTER F. HOLMES, District 7, 181 Allen Street, E. Braintree.	
JOHN A. FARLEY, District 8, Plymouth, R. F. D.	

CO-OPERATIVE SCIENTIFIC STAFF.

L. O. HOWARD, Ph.D.,	Chief, Bureau of Entomology, United States Department of Agriculture, Washington, D. C., parasites and predaceous insects.
THEOBALD SMITH, Ph.B., M.D.,	Professor of Comparative Pathology, Harvard University, diseases of insects.
ROLAND THAXTER, Ph.D.,	Professor of Cryptogamic Botany, Harvard University, fungous diseases affecting insects.
W. M. WHEELER, Ph.D.,	Professor of Entomology, Harvard University, experimental entomologist.

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS.

[Alphabetically by towns and cities.]

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
57-W, Rockland, .	Arthur B. Reed, . .	Abington, . .	C. F. Shaw, . .	8
10-4, . . .	W. H. Kingsley, . .	Acton, . . .	J. O'Neil, . . .	5
2003-M, . . .	Henry F. Taber, . .	Acushnet, . .	A. P. R. Gilmore, .	9
2-0, Kippers, .	John Clancy, . . .	Adams, . . .	John Clancy, . .	6
3165-11, . . .	E. M. Hitchcock, . .	Agawam, . . .	- - -	-
151-32, Great Bar- rington.	J. H. Wilcox, State Line,	Alford, . . .	- - -	-
274-M, . . .	James E. Feltham, . .	Amesbury, . .	A. L. Stover, . .	3
174-Y, . . .	A. F. Bardwell, . . .	Amherst, . . .	W. H. Smith, . .	6
212, . . .	John H. Baker, . . .	Andover, . . .	J. H. Playdon, . .	4
35 or 206, . .	Walter H. Pierce, . .	Arlington, . .	W. H. Bradley, . .	1
2-12, . . .	J. T. Withington, . .	Ashburnham, .	Chas. H. Pratt, . .	5
8014, . . .	Wm. S. Green, . . .	Ashby, . . .	Fred C. Allen, . .	5
4-12, . . .	Chas. A. Hall, . . .	Ashfield, . . .	- - -	-
479-W, . . .	Horace H. Piper, . .	Ashland, . . .	M. Geoghan, . .	7
48-J or 72-4, .	Frank P. Hall, . . .	Athol, . . .	W. S. Penniman, .	6
34-4, . . .	Hiram R. Packard, . .	Attleborough, .	W. E. S. Smith, . .	7
5-17, . . .	J. F. Searle, . . .	Auburn, . . .	J. F. Searle, . .	6
3259-M, . . .	J. W. McCarty, . . .	Avon, . . .	W. W. Beals, . .	8
96-4 or 47-4, .	Chas. E. Perrin, . .	Ayer, . . .	D. C. Smith, . .	5
144-2, . . .	Henry C. Bacon, Hyannis,	Barnstable, . .	H. C. Bodfish, . .	9
83-4, . . .	A. E. Traver, . . .	Barre, . . .	G. R. Simonds, . .	6
11-4, . . .	P. B. McCormick, . .	Becket, . . .	- - -	-
No telephone, .	Chas. E. Williams, . .	Bedford, . . .	W. A. Cutler, . .	1
10, . . .	Jas. A. Peeso, . . .	Belchertown, .	E. C. Howard, . .	6
8157-22, Milford,	L. Francis Thayer, . .	Bellingham, . .	H. A. Whitney, . .	7
409-W, . . .	John F. Leonard, . .	Belmont, . . .	C. H. Houlahan, . .	1
1367-M, . . .	G. H. Babbitt, Taunton, R. F. D.	Berkley, . . .	J. M. Alexander, . .	7
14-6, . . .	Walter Cole, . . .	Berlin, . . .	E. C. Ross, . .	5
2-13, . . .	Edson W. Hale, . . .	Bernardston, .	Edwin B. Hale, . .	6
319-2, . . .	Robert H. Grant, . .	Beverly, . . .	J. B. Brown, . .	2
22-2, . . .	E. N. Bartlett, . . .	BillERICA, . .	W. H. O'Brien, . .	4
875-L-1, Woon- socket.	Thomas Reilly, . . .	Blackstone, . .	A. J. Gibbons, . .	6
12-2, . . .	I. E. Whitney, . . .	Blandford, . .	- - -	-
9-14, . . .	E. Eliot Hurlbut, . .	Bolton, . . .	C. E. Mace, . .	5
- - -	- - -	Boston, . . .	D. H. Sullivan, . .	1
- - -	Emory A. Ellis, Bourne- dale.	Bourne, . . .	Edward D. Nick- erson,	9
No telephone, .	H. J. Livermore, . .	Boxborough, . .	C. E. Sherry, . .	5

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
42-21, George- town.	Harry L. Cole, George- town, R. F. D.	Bonford, . .	C. Perley, . .	3
4-4,	John N. Flagg,	Boylston, . .	R. B. Smith, . .	6
No telephone, .	Jas. M. Cutting, South Braintree.	Braintree, . .	Clarence R. Bee- tick.	8
No telephone, .	T. B. Tubman,	Brewster, . .	Russell D. Eaton,	9
8-6,	Edwin S. Rhoades,	Bridgewater, .	A. W. MacFarland,	8
14-3,	Geo. E. Hitchcock,	Brimfield, . .	G. E. Hitchcock, .	6
1041 or 2020, .	Harry L. Marston,	Brockton, . .	E. P. Neasey, . .	8
101-13,	Elbert L. Bemis,	Brookfield, . .	J. H. Conant, . .	6
376,	Geo. H. Johnson,	Brookline, . .	Ernest B. Dane, . .	1
Lampson & Good- now Mfg. Co.	Wm. Sauer, Shelburne Falls.	Buckland, . .	- -	-
2-2,	W. W. Skelton,	Burlington, . .	W. W. Skelton, . .	1
51-4,	Robert C. Hughes,	Canton, . . .	A. Hemenway, . .	8
- -	- -	Cambridge, . .	J. F. Donnelly, . .	1
76-5, Concord, .	Geo. G. Wilkins,	Carlisle, . . .	G. G. Wilkins, . .	1
16-2,	Herbert F. Atwood,	Carver, . . .	H. F. Atwood, . .	9
10,	Edwin C. Vincent,	Charlemont, . .	- -	-
32-22,	Chas. S. McKinstry,	Charlton, . . .	J. D. Fellows, . .	6
28-3,	Geo. W. Ryder, West Chatham.	Chatham, . . .	Meroy R. Martin,	9
1597-4, Lowell, .	Arnold C. Perham,	Chelmsford, . .	M. A. Bean, . . .	4
- -	- -	Chelsea, . . .	J. A. O'Brien, . .	1
167-3,	Chas. D. Cummings,	Cheshire, . . .	- -	-
33-2,	Myron E. Turner,	Chester, . . .	- -	-
8004,	Chas. A. Bisbee, Bisbees,	Chesterfield, .	- -	-
149-11 or 149-W, .	John E. Pomphret,	Chicopee, . . .	Z. Pilland, . . .	6
No telephone, .	Ernest C. Mayhew,	Chilmark, . . .	A. S. Tilton, . . .	9
No telephone, .	Danforth Blanchard, North Adams, R. F. D.	Clarksburg, . .	Geo. Tisdale, . . .	6
551-M,	Patrick H. Kelley,	Clinton, . . .	John B. Connery,	5
177-3 or 260, . .	Wm. J. Brennock,	Cohasset, . . .	Wm. H. McArthur,	8
13-12,	J. D. Gilcrest, Griswold- ville.	Colrain, . . .	- -	-
75-3,	Frank W. Holden,	Concord, . . .	H. P. Richardson,	5
5-3,	Edgar Jones,	Conway, . . .	- -	-
8001,	Thos. A. Gabb,	Cummington, .	- -	-
57-11,	S. L. Caesar,	Dalton, . . .	- -	-
No telephone, .	Thos. L. Thayer, North Dana.	Dana, . . .	T. L. Thayer, . . .	6
295-W,	Michael H. Barry,	Danvers, . . .	T. E. Tinsley, . .	2
14-3, Westport, .	Ezekiel W. Reed, North Dartmouth.	Dartmouth, . .	E. M. Munson, . .	9
35-R,	H. J. Harrigan,	Dedham, . . .	J. T. Kennedy, . .	7
273-14, Greenfield,	Wm. L. Harris,	Deerfield, . .	- -	-

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
No telephone, .	Alpheus P. Baker, . .	Dennis, . .	H. H. Sears, . .	9
29-3, . . .	Ralph Earle, . . .	Dighton, . . .	D. F. Lane, . .	7
11-4, . . .	Wm. L. Church, . . .	Douglas, . . .	F. J. Libby, . .	6
373-3, . . .	John Breagy, . . .	Dover, . . .	H. L. MacKensie, .	7
3353-2, . . .	Frank H. Gunther, . .	Dracut, . . .	T. F. Carriek, . .	4
152-2, Webster, .	F. A. Putnam, . . .	Dudley, . . .	Frank W. Bate- man, . .	6
5-11, Tyngsbor- ough, . . .	Archie W. Swallow, . .	Dunstable, . . .	W. H. Savill, . .	4
- -	Eden W. Soule, . . .	Duxbury, . . .	H. A. Fish, . . .	9
146-5, . . .	Richard H. Copeland, Box 115, Elmwood, . .	E. Bridgewater, . .	Frank H. Taylor, .	8
8-5, . . .	Asher Markham, . . .	E. Longmeadow, . .	- -	-
24-3, . . .	Adin L. Gill, . . .	Eastham, . . .	N. P. Clark, . . .	9
2-11, . . .	J. M. Dineen, . . .	Easthampton, . . .	- -	-
76, . . .	Frederick Hanlon, North Easton, . . .	Easton, . . .	R. W. Melendy, . .	7
241-2, . . .	Manuel S. Roberts, . .	Edgartown, . . .	John P. Fuller, . .	9
165-25, . . .	Frank W. Bradford, Great Barrington, . . .	Egremont, . . .	- -	-
2-11, . . .	Herbert A. Coolbeth, . .	Enfield, . . .	C. H. Morse, . . .	6
No telephone, .	Chas. H. Holmes, Far- ley, . . .	Erving, . . .	Chas. H. Holmes, .	6
23-5, . . .	Otis O. Story, . . .	Essex, . . .	O. O. Story, . . .	2
- -	- -	Everett, . . .	J. Davidson, . . .	1
675-R or 675-W,	Wm. P. Shaw, . . .	Fairhaven, . . .	G. W. King, . . .	9
822-W, . . .	Wm. Stevenson, . . .	Fall River, . . .	Wm. Stevenson, . .	9
136-2, . . .	H. H. Lawrence, Tea- ticket, . . .	Falmouth, . . .	W. B. Bosworth, . .	9
745 or 143-J, .	W. W. Colton, . . .	Fitchburg, . . .	W. W. Colton, . . .	5
Hoosac Tunnel pay station, . .	H. B. Brown, Drury, . .	Florida, . . .	- -	-
15-5 or 76-3, .	Ernest A. White, . . .	Foxborough, . . .	F. S. Richardson, .	7
352-4 South Fram- ingham, . . .	B. P. Winch, . . .	Frammingham, . . .	N. I. Bowditch, . .	7
66-12, . . .	Edward S. Cook, . . .	Franklin, . . .	J. W. Stobbart, . .	7
3-12, . . .	Andrew Hathaway, As- sonet, . . .	Freetown, . . .	G. M. Nichols, . . .	9
191-M, . . .	Geo. S. Hodgman, . . .	Gardner, . . .	T. W. Danforth, . .	6
- -	Leander B. Smalley, Me- nemsha, . . .	Gay Head, . . .	J. W. Belain, . . .	9
31-4, . . .	Clinton J. Eaton, . . .	Georgetown, . . .	C. J. Eaton, . . .	3
4-15, Bernardston,	Lewis C. Munn, Turners Falls, . . .	Gill, . . .	A. Tuttle, . . .	6
547-5, . . .	Sydney F. Haskell, . .	Gloucester, . . .	H. J. Worth, . . .	2
18-4, . . .	John S. Mollison, Wil- liamsburg, . . .	Goshen, . . .	- -	-
No telephone, .	Rodney E. Bennett, . .	Gosnold, . . .	- -	-
8000, . . .	Sumner F. Leonard, . .	Grafton, . . .	C. K. Despeau, . .	6
55-4, . . .	C. N. Rust, . . .	Granby, . . .	Chas. N. Rust, . .	6
4-12, . . .	Harry A. Root, . . .	Granville, . . .	- -	-

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
5-W, . . .	Daniel W. Flynn, . . .	Gt. Barrington,	T. J. Kearin, . . .	6
439-J, . . .	J. W. Bragg, . . .	Greenfield, . . .	J. W. Bragg, . . .	6
33-24 Enfield, . . .	Wm. H. Walker, Green- wich Village.	Greenwich, . . .	E. A. Sawtelle, . . .	6
- -	Chas. M. Raddin, . . .	Groton, . . .	J. F. Bateman, . . .	4
2939-X, . . .	Sidney E. Johnson, . . .	Groveland, . . .	R. B. Larive, . . .	3
651-33, . . .	Edward P. West, . . .	Hadley, . . .	Edw. P. West, . . .	6
5-21, . . .	Albion D. Estes, . . .	Halifax, . . .	F. D. Lyons, . . .	9
128-2, . . .	Fred Berry, Essex, R. F. D.	Hamilton, . . .	E. G. Brewer, . . .	2
- -	Edward P. Lyons, . . .	Hampden, . . .	- -	-
17-F-2, . . .	Chas. F. Tucker, . . .	Hancock, . . .	- -	-
8175-12, . . .	Chas. E. Damon, North Hanover.	Hanover, . . .	L. Russell, . . .	8
8012-6 Bryant- ville.	Albert L. Dame, South Hanson.	Hanson, . . .	A. L. Dame, . . .	9
- -	Henry J. Breen, . . .	Hardwick, . . .	P. J. Humphrey, . . .	6
46-3, . . .	Benj. J. Priest, . . .	Harvard, . . .	G. C. Maynard, . . .	5
Central, . . .	John Condon, . . .	Harwich, . . .	Arthur F. Cahoon, . . .	9
6-3, . . .	John M. Strong, West Hatfield.	Hatfield, . . .	Seth W. Kingsley, . . .	6
4-2 or 4-1, . . .	John B. Gordon, . . .	Haverhill, . . .	M. J. Fitzgerald, . . .	4
12-13, . . .	Melvin H. White, Charle- mont.	Hawley, . . .	- -	-
5-18, . . .	S. G. Benson, . . .	Heath, . . .	- -	-
21305, . . .	Geo. Cushing, . . .	Hingham, . . .	T. L. Murphy, . . .	8
- -	Louis B. Brague, . . .	Hinsdale, . . .	- -	-
No telephone, . . .	Walter E. Hooker, . . .	Holbrook, . . .	F. T. White, . . .	8
42-4, . . .	Winfred H. Stearns, Jef- ferson.	Holden, . . .	W. H. Stearns, . . .	6
5-21, . . .	Oliver L. Howlett, South- bridge, R. F. D.	Holland, . . .	A. F. Blodgett, . . .	6
1-2, . . .	W. A. Collins, . . .	Holliston, . . .	Herbert E. Jones, . . .	7
2295-W, . . .	C. J. Healey, . . .	Holyoke, . . .	- -	-
283-12, . . .	Walter F. Durgin, . . .	Hopedale, . . .	W. F. Durgin, . . .	6
Central, . . .	R. I. Frail, . . .	Hopkinton, . . .	W. A. MacMillan, . . .	6
6-13, . . .	E. A. Young, . . .	Hubbardston, . . .	E. A. Young, . . .	6
207-M, . . .	Wm. L. Wolcott, . . .	Hudson, . . .	F. P. Hosmer, . . .	5
248-W, . . .	Smith F. Sturges, Aller- ton.	Hull, . . .	J. Knowles, . . .	8
- -	John J. Kirby, . . .	Huntington, . . .	- -	-
- -	Pindar F. Bussell, . . .	Ipswich, . . .	J. A. Morey, . . .	3
- -	Arthur B. Holmes, . . .	Kingston, . . .	R. F. Randall, . . .	9
261-2, . . .	Nathan F. Washburn, . . .	Lakeville, . . .	N. F. Washburn, . . .	9
218-J, . . .	Arthur W. Blood, . . .	Lancaster, . . .	L. R. Griswold, . . .	5
717-5, Pittsfield, . . .	King D. Keeler, . . .	Lanesborough, . . .	- -	-
362, . . .	Dennis E. Carey, . . .	Lawrence, . . .	I. B. Kelly, . . .	4

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
66-3, . . .	Jas. W. Bossidy, . . .	Lee, . . .	- -	-
37-5, . . .	B. H. Fogwell, . . .	Leicester, . . .	J. H. Woodhead, . .	6
135, . . .	O. R. Hutchinson, . .	Lenox, . . .	T. Francis Mackey, .	6
546 or 28, . .	Fred A. Russell, . . .	Leominster, . . .	D. E. Bassett, . . .	5
9-44, Cooleyville,	O. C. Marvel, North Lev- erett.	Leverett, . . .	H. W. Field, . . .	6
468, . . .	Asor P. Howe, . . .	Lexington, . . .	A. P. Howe, . . .	1
284-11, . . .	Jacob Sauter, . . .	Leyden, . . .	Wm. A. Campbell, .	6
45-W, . . .	J. J. Kelliher, . . .	Lincoln, . . .	J. J. Kelliher, . . .	5
17-4, . . .	A. E. Hopkins, . . .	Littleton, . . .	A. E. Hopkins, . . .	5
1233-2, . . .	O. C. Pomeroy, . . .	Longmeadow, . . .	- -	-
201-12, . . .	E. F. Saunders, . . .	Lowell, . . .	J. H. Gordon, . . .	4
17-13, . . .	Edward E. Chapman, .	Ludlow, . . .	- -	-
20, . . .	Jas. S. Gilchrest, . .	Lunenburg, . . .	James S. Gilchrest, .	5
1174, . . .	Herbert C. Bayrd, . .	Lynn, . . .	G. H. McPhetres, . .	2
6-3, Lynnfield Center.	Thos. E. Cox, Wakefield, R. F. D.	Lynnfield, . . .	L. H. Twiss, . . .	1
- -	R. W. Noyes, . . .	Malden, . . .	W. B. Gould, . . .	1
319-W, . . .	Peter A. Sheahan, . .	Manchester, . . .	R. I. Crocker, . . .	2
1-3 or 1-2, . .	Herbert E. King, . . .	Mansfield, . . .	Marvin J. Hills, . .	7
226-W, . . .	Wm. H. Stevens, . . .	Marblehead, . . .	W. H. Stevens, . . .	2
117-2, . . .	Geo. B. Nye, . . .	Marion, . . .	J. Allenack, . . .	9
416 or 151-M, .	E. C. Minehan, . . .	Marlborough, . . .	M. E. Lyons, . . .	5
43-3, . . .	Wm. G. Ford, . . .	Marshfield, . . .	P. R. Livermore, . .	9
19-11, Cotuit, .	Jos. A. Peters, . . .	Masspee, . . .	W. F. Hammond, . .	9
52-4, . . .	Chas. W. Ellis, . . .	Mattapoisett, . . .	Thos. C. Tinkham, .	9
138-3, . . .	Geo. H. Gutteridge, . .	Maynard, . . .	A. Coughlin, . . .	5
106-4, . . .	Waldo E. Kingsbury, .	Medfield, . . .	G. L. L. Allen, . . .	7
53 or 138, . .	Chas. E. Bacon, . . .	Medford, . . .	W. J. Gannon, . . .	1
No telephone, .	A. Le Barron Treen, West Medway.	Medway, . . .	F. Hager, . . .	7
- -	-	Melrose, . . .	J. J. McCullough, .	1
156-6, . . .	Frank M. Aldrich, . . .	Mendon, . . .	F. M. Aldrich, . . .	6
21-3, . . .	Edgar P. Sargent, . . .	Merrimac, . . .	C. R. Ford, . . .	3
229, . . .	Herbert Nichols, . . .	Methuen, . . .	A. H. Wagland, . . .	4
36 or 5, . . .	Chester E. Weston, . .	Middleborough, . . .	A. D. Nelson, . . .	9
8003-2, . . .	Thos. H. Fleming, Ban- croft.	Middlefield, . . .	- -	-
No telephone, .	Oscar H. Sheldon, . . .	Middleton, . . .	B. T. McGlauffin, .	3
65-3, . . .	Elbert M. Crockett, . .	Millford, . . .	P. F. Fitzgerald, . .	6
- -	Harry L. Snelling, . . .	Millbury, . . .	E. F. Roach, . . .	6
5-2, . . .	Chas. LaCroix, . . .	Millis, . . .	E. W. Stafford, . . .	7

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
322, . . .	Nathaniel T. Kidder,	Milton, . . .	N. T. Kidder, . . .	8
No telephone, . . .	S. R. Tower, . . .	Monroe, . . .	- -	-
12-22, . . .	O. E. Bradway, . . .	Monson, . . .	Robert S. Fay, . . .	6
278-15, Greenfield,	Fred T. Lyman, . . .	Montague, . . .	Dennis F. Shea, . . .	6
164-4, . . .	D. C. Tryon, . . .	Monterey, . . .	- -	-
3-24, Russell, . . .	Andrew J. Hall, . . .	Montgomery, . . .	- -	-
17-21 Copoke, N. Y. - -	G. W. Patterson, . . .	Mt. Washington, . . .	- -	-
- -	- -	Nahant, . . .	T. Roland, . . .	2
- -	Richard A. Brooks, . . .	Nantucket, . . .	C. C. Macy, . . .	9
31 or 244-2, . . .	Bernard E. Darling, . . .	Natick, . . .	H. S. Hunnewell, . . .	7
195-1, . . .	Howard H. Upham, . . .	Needham, . . .	E. E. Riley, . . .	7
No telephone, . . .	Chas. S. Baker, . . .	New Ashford, . . .	- -	-
2280 or 353, . . .	Edward F. Dahill, . . .	New Bedford, . . .	C. F. Lawton, . . .	9
6-4, . . .	Frank A. Morse, . . .	New Braintree, . . .	E. L. Havens, . . .	6
13-6, Sheffield, . . .	E. M. Stanton, Mill River,	N. Marlborough, . . .	- -	-
Pay Station, . . .	Rawson King, . . .	New Salem, . . .	R. King, . . .	6
173-5, Newbury- port.	Wm. P. Bailey, . . .	Newbury, . . .	Percy Oliver, . . .	3
380, . . .	Chas. P. Kelley, . . .	Newburyport, . . .	C. P. Kelly, . . .	3
30, N. S., . . .	W. B. Randlett, Newton Center.	Newton, . . .	C. I. Buckman, . . .	1
41-5, . . .	Jas. T. Buckley, . . .	Norfolk, . . .	James T. Buckley, . . .	7
205-W or 265, . . .	H. J. Montgomery, . . .	North Adams, . . .	Franklin B. Locke, . . .	6
821-W, . . .	Geo. A. Rea, . . .	North Andover, . . .	Fred W. Phelan, . . .	4
17-2, . . .	Chas. F. Gehrung, . . .	N. Attleborough, . . .	F. P. Toner, . . .	7
26-14, . . .	Geo. O. Rollins, . . .	N. Brookfield, . . .	S. D. Colburn, . . .	6
33-3, . . .	Henry Upton, . . .	North Reading, . . .	G. E. Eaton, . . .	1
165, . . .	F. E. Chase, . . .	Northampton, . . .	Christopher Clarke, . . .	6
14-5, . . .	T. P. Haskell, . . .	Northborough, . . .	T. P. Haskell, . . .	6
71-5, . . .	W. E. Burnap, Whitins- ville.	Northbridge, . . .	A. F. Whitin, . . .	6
2-3, . . .	Fred W. Doane, . . .	Northfield, . . .	F. W. Doane, . . .	6
29-11, . . .	Geo. H. Storer, . . .	Norton, . . .	G. H. Storer, . . .	7
11-4, . . .	John Whalen, . . .	Norwell, . . .	J. H. Sparrell, . . .	8
55-4, . . .	Frank W. Talbot, . . .	Norwood, . . .	Ebin F. Gray, . . .	7
119-4, . . .	Frank W. Chase, . . .	Oak Bluffs, . . .	P. P. Hurley, . . .	9
17-5, . . .	Chas. H. Trowbridge, . . .	Oakham, . . .	C. H. Trowbridge, . . .	6
67-13, . . .	Frank M. Jennison, . . .	Orange, . . .	F. M. Jennison, . . .	6
- -	James Boland, . . .	Orleans, . . .	A. Smith, . . .	9
15, . . .	Durand A. Witter, . . .	Otis, . . .	- -	-
9-5, . . .	Olin D. Vickers, . . .	Oxford, . . .	C. G. Larned, . . .	6

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
53-12 or 53-3, . .	James Summers, . . .	Palmer, . . .	C. H. Keith, . . .	6
- - . . .	Fred L. Durgin, . . .	Paxton, . . .	F. L. Durgin, . . .	6
18-3, . . .	M. V. McCarthy, . . .	Peabody, . . .	J. F. Callahan, . . .	1
242-4, . . .	Myron N. Allen, . . .	Pelham, . . .	- - . . .	-
7-23, Bryantville, . .	Jos. J. Shepherd, . . .	Pembroke, . . .	J. J. MacFarlan, . . .	9
54-3 or 12-5, . .	Geo. G. Tarbell, East Pepperell, . . .	Pepperell, . . .	J. Tune, . . .	4
- - . . .	Walter H. Pike, . . .	Peru, . . .	- - . . .	-
13-2, . . .	Geo. P. Marsh, . . .	Petersham, . . .	David Broderick, . . .	6
176-6, Athol, . .	Wm. Cowlbeck, Athol, R. F. D. . .	Phillipston, . . .	W. H. Cowlbeck, . . .	6
149 or 964, . .	Wm. C. Shepard, . . .	Pittsfield, . . .	- - . . .	-
33-22, . . .	Albert F. Dyer, . . .	Plainfield, . . .	- - . . .	-
283-J, North Attleborough, . .	R. P. Rhodes, . . .	Plainville, . . .	Ralph Snell, . . .	7
88-W or 197-W, . .	Herbert Morissey, . . .	Plymouth, . . .	A. A. Raymond, . . .	9
11-14, . . .	Thos. W. Blanchard, . . .	Plympton, . . .	D. Bricknell, . . .	9
19-4, Highland, . .	A. W. Doubleday, Greenwich Village, . . .	Prescott, . . .	C. M. Pierce, . . .	6
13-4, . . .	Fred W. Bryant, . . .	Princeton, . . .	F. A. Skinner, . . .	6
17, Special, . .	Albert W. Fuller, . . .	Provincetown, . . .	J. M. Burch, . . .	9
601 or 1, . . .	A. L. Litchfield, . . .	Quincy, . . .	A. J. Stewart, . . .	8
35-4, Randolph, . .	R. F. Forrest, . . .	Randolph, . . .	Chas. Cole, . . .	8
1284-R, . . .	John V. Festing, . . .	Raynham, . . .	G. M. Leach, . . .	7
518-W, . . .	H. E. McIntire, . . .	Reading, . . .	H. M. Donegan, . . .	1
11-12, . . .	Benj. F. Monroe, Attleborough, R. F. D. . .	Rehoboth, . . .	S. W. Robinson, . . .	7
- - . . .	- - . . .	Revere, . . .	G. P. Babson, . . .	1
8-2, . . .	T. B. Salmon, . . .	Richmond, . . .	- - . . .	-
No telephone, . .	Daniel E. Hartley, Mattapoisett, R. F. D. . .	Rochester, . . .	Edw. F. Handy, . . .	9
55-4, . . .	John H. Burke, . . .	Rockland, . . .	F. H. Shaw, . . .	8
27-3, . . .	A. J. McFarland, . . .	Rockport, . . .	F. A. Babcock, . . .	2
21-6, Charlemont, . .	Merritt A. Peck, Zoar, . . .	Rowe, . . .	- - . . .	-
3-15, . . .	Daniel O'Brien, . . .	Rowley, . . .	L. R. Bishop, . . .	3
270-2, Athol, . .	L. G. Forbes, . . .	Royalston, . . .	A. H. Brown, . . .	6
- - . . .	S. S. Shurtleff, . . .	Russell, . . .	- - . . .	-
13-3, . . .	Henry Converse, . . .	Rutland, . . .	H. E. Wheeler, . . .	6
- - . . .	- - . . .	Salem, . . .	Warren P. Hale, . . .	2
- - . . .	Chas. I. Dow, . . .	Salisbury, . . .	H. C. Rich, . . .	3
202-14, Winsted, Conn. . .	Lyman H. Clark, New Boston, . . .	Sandisfield, . . .	- - . . .	-
52-14, Sagamore, . .	John F. Carlton, . . .	Sandwich, . . .	B. F. Dennison, . . .	9
115, . . .	Chas. L. Davis, . . .	Saugus, . . .	T. E. Berrett, . . .	1
3-3, . . .	Herbert H. Fitzroy, . . .	Savoy, . . .	- - . . .	-

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
98-2, . . .	Henry T. Cole, . . .	Scituate, . . .	P. S. Brown, . . .	8
399-L-5, Paw- tucket.	John L. Baker, Attlebor- ough, R. F. D.	Seekonk, . . .	C. W. Thompson, . .	7
121-2, . . .	A. Alden Carpenter, . .	Sharon, . . .	J. J. Geissler, . . .	7
24-2, . . .	Arthur H. Tuttle, . . .	Sheffield, . . .	- -	-
130-2, . . .	Chas. S. Dole, Shelburne Falls.	Shelburne, . . .	- -	-
11-4, Natick, . .	Milo F. Campbell, . . .	Sherborn, . . .	J. P. Dowse, . . .	7
16-21, . . .	A. A. Adams, . . .	Shirley, . . .	A. A. Adams, . . .	5
48-3, . . .	Edward A. Logan, . . .	Shrewsbury, . . .	C. R. Webb, . . .	6
2-21, . . .	Fred Aldrich, . . .	Shutesbury, . . .	E. Colfax Johnson, .	6
- -	Wm. F. Griffiths, Swan- sea, R. F. D.	Somerset, . . .	C. Riley, . . .	7
- -	- -	Somerville, . . .	A. B. Pritchard, . .	1
471-W, Holyoke, .	Louis H. Lamb, South Hadley Falls.	South Hadley, . . .	Wm. McLeod, . . .	6
153-2, . . .	Dana Howland, . . .	Southampton, . . .	C. S. Olds, . . .	6
13, Marlborough, .	Harry Burnett, . . .	Southborough, . . .	H. Burnett, . . .	6
11, . . .	Aimee Langevin, . . .	Southbridge, . . .	A. Langevin, . . .	6
8-2, . . .	Benj. M. Hastings, . . .	Southwick, . . .	- -	-
77-4, . . .	A. F. Howlett, . . .	Spencer, . . .	G. Ramer, . . .	6
20, Indian Or- chard.	T. J. Clifford, Indian Orchard.	Springfield, . . .	W. F. Gale, . . .	6
5-12, . . .	Joel T. Wilder, . . .	Sterling, . . .	J. H. Kilburn, . . .	5
Post Office, . . .	Geo. Schneyer, Glendale,	Stockbridge, . . .	Brown Caldwell, . .	6
207-R or 127-M, .	Louis F. Bruce, . . .	Stoneham, . . .	G. M. Jefts, . . .	1
121-3 or 8120, . .	James Curley, . . .	Stoughton, . . .	W. P. Kennedy, . . .	8
134-J, Hudson, . .	W. H. Parker, Gleason- dale.	Stow, . . .	G. A. Patterson, . .	5
6-21, . . .	Chas. M. Clark, Fiskdale,	Sturbridge, . . .	C. M. Clark, . . .	6
5-5, . . .	S. W. Hall, South Sud- bury.	Sudbury, . . .	W. E. Baldwin, . . .	5
46, . . .	A. C. Warner, . . .	Sunderland, . . .	Richard Graves, . . .	6
49-16, Millbury, .	R. H. Richardson, . . .	Sutton, . . .	Ransom H. Rich- ardson.	6
3806 or 82, . . .	Geo. P. Cahoon, . . .	Swampscott, . . .	E. P. Mudge, . . .	2
468-W, . . .	Thos. L. Mason, . . .	Swansea, . . .	A. E. Arnold, . . .	7
320 or 1-3, . . .	Fred A. Leonard, . . .	Taunton, . . .	L. W. Hodgkins, . .	7
23-3, . . .	A. R. Paine, Baldwins- ville.	Templeton, . . .	J. B. Wheeler, . . .	6
12-2, . . .	Harris M. Briggs, . . .	Tewksbury, . . .	H. M. Briggs, . . .	4
161-4 or 102-3, .	Elmer C. Chadwick, Vine- yard Haven.	Tisbury, . . .	H. W. McLellan, . .	9
No telephone, . .	Clayton H. Deming, . .	Tolland, . . .	- -	-
Central, . . .	Chas. W. Floyd, . . .	Topsfield, . . .	C. W. Floyd, . . .	3
11-2 or 37-2, . .	F. J. Piper, . . .	Townsend, . . .	G. E. King, . . .	4
- -	Walter F. Rich, . . .	Truro, . . .	J. H. Atwood, . . .	9
1, . . .	Otis L. Wright, . . .	Tyngsborough, . .	C. J. Allgrove, . . .	4

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
1-2, Lee, . . .	H. E. Moore, . . .	Tyringham, . . .	- -	-
7-2, . . .	E. M. Baker, Upton Cen- ter.	Upton, . . .	G. H. Evans, . . .	6
51-5, . . .	Lewis F. Rawson, . . .	Uxbridge, . . .	Willard Holbrook, . . .	6
455-M or 58, . . .	Wm. E. Cade, . . .	Wakefield, . . .	W. W. Whittredge, . . .	1
No telephone, . . .	Warren W. Eager, . . .	Wales, . . .	M. C. Royce, . . .	6
43-11, . . .	J. J. Hennessy, . . .	Walpole, . . .	P. R. Allen, . . .	7
6, . . .	Geo. L. Johnson, . . .	Waltham, . . .	W. M. Ryan, . . .	1
5-13, . . .	Louis A. Charbonneau, . . .	Ware, . . .	F. Zeissig, . . .	6
45-23, . . .	Delbert C. Keyes, South Wareham.	Wareham, . . .	J. J. Walsh, . . .	9
46-6, . . .	Jos. D. Vigneaux, West Warren.	Warren, . . .	A. A. Warriner, . . .	6
73-3, Orange, . . .	Chas. A. Williams, . . .	Warwick, . . .	Chas. E. Stone, . . .	6
12-4, . . .	Lester Heath, . . .	Washington, . . .	- -	-
116, Newton North.	John C. Ford, . . .	Watertown, . . .	J. C. Ford, . . .	1
- -	William Stearns, . . .	Wayland, . . .	D. J. Graham, . . .	5
113-4, . . .	Timothy Toomey, . . .	Webster, . . .	C. Klebart, . . .	6
172-W, . . .	Wm. W. Diehl, Wellesley Hills.	Wellesley, . . .	F. M. Abbott, . . .	7
- -	John Holbrook, . . .	Wellfleet, . . .	E. S. Jacobs, . . .	9
74-41, Orange, . . .	Harry J. McCoy, Wendell Depot.	Wendell, . . .	G. E. Mills, . . .	-
74-2, . . .	Jacob D. Barnes, . . .	Wenham, . . .	J. D. Barnes, . . .	2
3-21, . . .	Fred E. Clark, . . .	West Boylston, . . .	C. H. Baldwin, . . .	6
768, Brockton, . . .	W. P. Laughton, . . .	W. Bridgewater, . . .	O. Belmore, . . .	8
37-13, . . .	J. H. Webb, . . .	W. Brookfield, . . .	J. H. Webb, . . .	6
5-6, . . .	Louis H. Flook, . . .	W. Newbury, . . .	Frank D. Bailey, . . .	3
2067-1, . . .	Dana S. Moore, . . .	W. Springfield, . . .	Geo. W. Hayden, . . .	6
- -	Geo. B. Latour, . . .	W. Stockbridge, . . .	- -	-
203-23, . . .	Wm. J. Rotch, . . .	West Tisbury, . . .	H. W. Athearn, . . .	9
75-3, . . .	Thos. H. Treadway, . . .	Westborough, . . .	Geo. Hayden, . . .	6
111-Y, . . .	T. H. Mahoney, . . .	Westfield, . . .	- -	-
- -	Harry L. Nesmith, . . .	Westford, . . .	H. L. Nesmith, . . .	4
148-14, . . .	C. A. Bartlett, Northamp- ton, Stage.	Westhampton, . . .	- -	-
29-4, . . .	W. H. Waterhouse, . . .	Westminster, . . .	G. A. Sargent, . . .	6
1392-M, . . .	Benj. R. Parker, . . .	Weston, . . .	E. P. Ripley, . . .	5
No telephone, . . .	Herbert A. Sanford, . . .	Westport, . . .	H. A. Sanford, . . .	9
- -	Elmer E. Smith, Islington, . . .	Westwood, . . .	C. H. Southerland, . . .	7
154-W, . . .	Edgar S. Wright, . . .	Weymouth, . . .	C. L. Merriitt, . . .	8
69-2, South Deer- field.	James A. Wood, . . .	Whately, . . .	- -	-
104-14, . . .	C. A. Randall, . . .	Whitman, . . .	C. A. Randall, . . .	-
1-4, . . .	Henry I. Edson, . . .	Wilbraham, . . .	F. B. Metcalf, . . .	6

LIST OF FOREST WARDENS AND LOCAL MOTH SUPERINTENDENTS — *Con.*

TELEPHONE NUMBER.	Forest Warden.	Town or City.	Local Moth Superintendent.	Div. No.
46-2, . . .	J. Edward Pierpont, .	Williamsburg, .	- -	-
34-14, . . .	William Davies, . .	Williamstown, .	Wm. Davies, .	6
34-4, . . .	Howard M. Horton, .	Wilmington, .	O. McGrane, .	1
29, . . .	Arlon D. Bailey, . .	Winchendon, .	G. W. Drury, .	6
123-2, . . .	David H. DeCourcy, .	Winchester, .	S. S. Symmes, .	1
201-12, Dalton, .	Amos Ferry, . . .	Windsor, . . .	- -	-
- -	- -	Winthrop, . . .	W. A. Whittemore, .	2
110, . . .	Frank E. Tracy, . .	Woburn, . . .	J. H. Kelley, .	1
7112, Park, . .	Arthur V. Parker, . .	Worcester, . .	H. J. Neale, . .	6
10-22, . . .	Chas. Kilbourn, . .	Worthington, .	- -	-
- -	Geo. H. E. Mayshaw, .	Wrentham, . .	W. Gilmore, . .	7
53-33, . . .	Jos. W. Hamblin, . .	Yarmouth, . .	C. R. Bassett, .	9

WINCHENDON SHOWING MUCH INTEREST IN FORESTRY.

One of the first towns in the State to co-operate with this department was the town of Winchendon. Practical undertakings were begun by some of the farsighted and stable business men of the town, and these have been splendid object lessons. The late Mr. John Folsom, who had been the official in charge of the town trees for years, spent his last days in interesting his townsmen in reforestation and in practicing modern forestry. Winchendon village is a beautiful New England hamlet nestling in a valley of the town, which borders the New Hampshire line, and at an elevation of over 1,000 feet. The chief industries of the town are those requiring quantities of forest products, particularly white pine. Winchendon is noted for its productions of wooden pails, tubs, toys, ice-cream freezers and a variety of manufactured wooden products. The numerous factories here established are dependent for their future raw material upon the forests. The country about Winchendon is ideally adapted for forestry, and offers an exceptional opportunity to demonstrate how valuable an asset modern forestry can be made to a Massachusetts or New England town. In a natural forest country, like that found in rural sections of this State, there are great possibilities for our people to gain a



A view from the lookout station on Robbins Hill, Chelmsford, looking toward Boston. Note the amount of forest country.



A forest nursery in the town of Neustadt, Ger. Were some of our rural towns to start such an enterprise in connection with the office of forest warden, tree warden and moth superintendent, it could be made a valuable auxiliary toward establishing town forests.

splendid and permanent livelihood, were we to develop similar industries for using and manufacturing home-grown forest products, as Winchendon is doing. This type of environment also builds up and engenders a healthful and happy people.

The moth scourge is just beginning to make some inroads in Winchendon, but it is believed that it will never amount to anything here, as the town immediately purchased up-to-date equipment, and will not allow the moths to trespass. At a recent meeting at which the State Forester gave an illustrated talk, showing slides comparing conditions in Massachusetts with the Black Forest of Germany, he emphasized how the town of Winchendon might be made the Black Forest town of New England, and the idea seemed to meet the general approval of both officials and citizens.

The town set out 10 acres to white pine last year as a start toward a municipal forest, and plans are already made for setting a much larger area next spring, and the acquisition of more territory. The Murdock Company, the Brown Brothers, the Converse Company and various individuals have already set out several hundred acres in this and adjoining towns. The Brown Brothers have about 1,000,000 two-year-old seedlings in their nursery at the present time, and Mr. Elisha Whitney, the president of the Murdock Company, has purchased for next spring's delivery a very large consignment. The accompanying photograph (see frontispiece) was taken by the writer of one of the Murdock Company's four-year Scotch pine plantations in the town of Ashburnham.

The true forestry spirit is to be found in Winchendon, and it is hoped that other rural towns may emulate this example. See, also, the Winchendon forest fire auto truck, a photograph of which is to be found in this report.

FORESTRY PRACTICES AS A KEY TO MOTH CONTROL.

This year for the first time an organized attempt has been made to apply forestry to the moth problem. Work along this line has been done for several years, notably on the North Shore, but the immediate purpose of most of the thinnings made was to facilitate spraying and creosoting rather than to

eradicate the favorable moth food. This year a special department was inaugurated to carry on this work under a trained forester.

The various means of controlling the moths may be classified under three heads, — direct entomological methods, indirect entomological methods and forestry methods. The direct entomological methods seek the destruction of the moths in one of their various forms by human agency, as in spraying or creosoting. The indirect methods seek the propagation of parasites or disease which will destroy the moths. The forestry methods seek the encouragement of tree growth which is unfavorable to the moths.

It has been found, from our own and from European observations and experiments, that although it will eat practically all kinds of vegetation, the gypsy moth thrives only on a limited number of species of trees. These trees, which are the oaks (especially the white oak), willow, fruit and cherry trees, and probably the gray birch, may be called "non-resistant" trees. Unless a large proportion of their food consists of the leaves of these "non-resistant" trees, under ordinary conditions the moths will soon pass on to a more favorable feeding ground or die. Therefore forestry methods, rather than attempting to destroy the moths themselves, would destroy their food. If we grow forests of resistant species, as conifers, maple, chestnut, ash, etc., the moths will cease to be destructive.

To shade trees and to ornamental or park woodland, where hardly a tree can be spared, these forestry methods do not apply very extensively, but in wild woodland spraying is too expensive and other methods are costly or inefficient, and we must rely on parasites, disease and resistant forest conditions if we are to control the moths. This is the way they are controlled in Europe, where they have existed from time immemorial, and this is the way we must eventually control them in this country. It is a vast work, the changing the forest conditions of this State, but if we can change the poor oak forests into pine forests, for which most of the land is naturally suited, the gypsy moth will turn out a blessing in disguise.

The white oak seems a doomed tree in the moth-infested region. Weakened by moth attacks, the "agrilus," or chestnut

borer, finds an easy entrance and soon kills it. The other oaks seem a little more resistant to both the moths and the borer, but except in very favorable soil it would not seem advisable to attempt to grow them unless they can be well taken care of by spraying. If oak is grown it should be kept in pure stands, for if grown in mixture, as with pine, both the oak and pine will be attacked. One owner of a very fine stand, consisting mostly of large white oaks, desired very much to save them. They were badly infested, and he spent large sums of money in spraying and creosoting them for several years. On account of the height of the trees, and the difficulty in always getting them sprayed thoroughly, they were eaten enough so that the borers found entrance, and this year it has been necessary for him to cut them all off after a large part of the stand had died. This shows the difficulty in saving white oak.

The primary purpose of moth thinnings is to remove from a stand non-resistant trees, and to leave and encourage the growth and reproduction of the resistant species. The secondary purposes are to aid in taking care of the stand by other and more direct methods of moth control; to increase the æsthetic value of the stand; to decrease the fire danger; to salvage the dead and dying trees; and increase the growth and health of the remaining trees by giving them more light and room. A moth thinning will not be efficient in checking the moths without the aid of spraying, unless practically all the non-resistant trees are removed and kept out. In a stand of pure oak, for instance, it will be necessary to cut clear and replant with resistant trees. In a stand which is 50 per cent. or more resistant, and the rest oak, the removal of all the oaks would still leave the ground fairly well shaded, and no replanting or spraying would be necessary. Owners should realize that it is foolish, year after year, to creosote and spray a grove of trees which is mostly resistant, when if they would only cut out the non-resistant trees and brush no other care would be necessary. This thing has been observed in a number of cases and persisted in, even after emphatic advice to the contrary. An interesting case was noted in Cohasset this year. There was a small area of large mixed hard woods surrounded by a growth of similar character. About half the trees were oak

and about half were of resistant species, as ash, hickory and maple. The moth infestation was very heavy, and when the area was examined in the early spring there were several hundred gypsy moth egg clusters on each tree. The owner did not want to spray, and he was advised to cut down all the oaks and await results. He did this, leaving only a very few oaks. He neither painted nor sprayed, nor did any of the surrounding owners. In July, when the moth eating was about completed, the area was again examined. The results surprised even the one who had advised this treatment. Whereas in the surrounding area there was almost a complete defoliation of all species, on the thinned tract practically all the leaves were intact, with the exception of those on the oaks that were not cut out. Of course this case may be exceptional, yet we believe it reveals the possibilities of resistant thinnings.

In the many areas of woodland where, on account of the large proportion of oak and the æsthetic value of the woods, a totally resistant thinning is impractical, moth thinnings are of great value as an aid to spraying. In fact, it is almost impossible to spray woodland effectively unless a certain amount of thinning has been done. The thinning makes the work more effective and lessens the cost from 25 to 60 per cent. In one area that a year ago was sprayed, unthinned, at a cost of nearly \$10 per acre, and even then was partly defoliated, this year, after thinning and brush-cutting, was sprayed at a cost of a little more than \$4 per acre, and practically no stripping occurred. The cost of thinning, including cutting and burning the brush, was about \$5 per acre, deducting the value of the wood cut. From this it is evident that in one year this thinning was a paying proposition to the owner. In thinning that is to be followed by spraying, and wherein the element of looks enters considerably, it is necessary to do much more cutting and disposing of brush than in straight, resistant thinnings. The care of the brush is one of the large factors of expense in this work. In purely resistant thinnings it is only necessary to cut the non-resistant brush, as scrub oak, witch-hazel and gray birch.

A good method of handling a stand that has a very high percentage of oak growth is to make a heavy thinning, cutting



A neglected and badly moth-infested woodland. The growth here is not large enough to pay for thinning, and contains quantities of dead trees, which condition is one of the worst to deal with. About all that can be done is to cut it clean and replant. There are many acres of this type and they are most discouraging propositions to the owners. Starvation methods may be practiced under favorable circumstances.



A woodland thinning to assist in controlling the gypsy moth. The favorite food trees are removed. The white pine is encouraged. A process of building over the forest. A thinned forest like this can be sprayed and looked after at far less expense. The forest products removed pay for the treatment. One hundred acres on the Weld estate, Dedham.

all white oaks if possible, and to follow this with underplanting of pine. Within ten years or so the rest of the oaks can be removed and a pine stand will result. This is not practicable, however, unless the area can be sprayed if necessary in the meantime. In many places examined there was considerable natural pine reproduction, and a thinning would aid very much in bringing it along. In other places, where the woodland is desired for landscape effect, as along roads or bordering fields, and where the growth is largely non-resistant, and spraying impractical over the whole area, then a strip can be left along the edge, but a clean cutting made in the interior followed by natural resistant reproduction, if possible, or planting. The outside strip can be cared for, and the interior will eventually sustain a moth-resistant growth, while the effect will not be injured.

Although we have not had sufficient experience as yet in this thinning work to show many results or make absolute conclusions, there are a few opinions which we have arrived at and which may be of interest to owners of infested woodland. They are as follows:—

1. Moth thinnings are constructive. The owner who uses direct methods of moth control must expect to keep them up year after year without any sure relief. By growing a resistant forest he is making the moth problem solve itself.

2. Moth thinnings are advantageous to the owners of park or ornamental woodland or land awaiting development. The main factor in land of this type is that the wooded character of the area be maintained and at the least possible expense. Thinnings will improve the general condition and attractiveness of the area and will make it much easier and cheaper to take care of in the future.

3. Moth thinnings are advantageous to the owners of woodland which is chiefly valuable for the wood it produces, provided the growth is of merchantable size. Woodland of this type cannot be annually sprayed because it is not worth it. If the owner leaves it alone, eventually most of the non-resistant trees, and many of the resistant species, will be killed and the stand greatly depreciate in value. A thinning of the non-resistant trees in woodland of fair to good quality will pay for

itself at least, and will leave a more valuable stand than if it had been left alone. It is also easier to cut live trees than dead ones.

4. Moth thinnings are advantageous to the owners of poor or sprout growth, where there is a considerable proportion of young pine present. The wood will not pay for the work, but the development of pine will. If left alone, especially where the growth is gray birch mixed with pine, the moths will practically destroy the whole value of the growth, which if properly conserved would prove to be considerable.

5. Moth thinnings are cheaper and more effective if undertaken before the moth infestation becomes serious than if made afterwards.

Considerable cost data have been collected from the thinning operations carried out under the direction of this department, but not enough to give any certain figures as yet. The main factors in the cost are the efficiency of the labor, the size and thickness of the growth, the severity of the thinning, the amount and method of brush-cutting and disposal, and the utilization and market of the product. In general terms it may be said that a thinning which will yield 7 or 8 cords to the acre will pay for itself, allowing for the burning of the slashing, provided that there is not an unusual amount of brush to be cut, and that ordinary labor and market conditions prevail. The cost mounts rapidly if large quantities of brush are to be cut. The cheapest way of doing work is by the cord, under good supervision, or an experienced crew working by the day may do as well. The profits may be considerable if there are many ties, poles or piles to be cut.

Work accomplished this Year.

Since this work was organized a gratifying amount of interest has been shown in thinning work. The work carried on has not been primarily experimental in character, but rather educational and practical. The United States Bureau of Entomology in connection with the Forest Service, is now carrying on experiments in moth thinnings under Mr. Clement, from which we anticipate some very practical data.

On account of the obvious necessity of getting this work started as rapidly as possible, we did not await the usual course of events and have the owners come in to us for advice and assistance, but rather went out after the owners and proffered our services. With the aid of the district and local moth superintendents a list was made of the owners of the infested woodland of the State, and to each owner was sent a letter offering our advice and help, and enclosing a blank to be signed if an examination of the property was desired. Over 2,000 such letters were sent out, and about 340 have returned the signed examination application to date. Up to December 1 we have been able to make 174 of these examinations, covering an area of about 9,628 acres. About 25 owners up to the present time have started this work, either under our supervision or with our assistance, and by these operations about 1,000 acres will have been put into condition. This does not include the thinnings done by the local or district moth superintendents, which will cover a large aggregate area.

In many towns all the roadsides and considerable private property have been thinned out by the local men, and in the town of Dover and on the North Shore considerable work has been done under special funds.

The aid offered to owners of infested woodland, outside of free advice, has been the marking of trees, the marketing of the wood, the furnishing of labor, and the actual supervision and management of the thinnings. In several cases we have found contractors who would cut the wood under our specifications and inspection and pay the owner for it. We have now three trained crews who will do the work under our direction for any owner who desires them, and will pay the actual cost. We have in other places furnished woodchoppers who cut by the cord under the supervision of a trained foreman. We expect to start out several new crews shortly.

A list of the areas cut or being cut under our direction and supervision follows: —

TOWN.	Owner.	Area (Acres).
Dover,	Geo. D. Hall,	27
Millis,	A. H. Wheeler,	12
Dedham,	Stephen M. Weld,	70
Dedham,	Mrs. J. C. Fairchild,	0
Westwood,	C. J. Lennon,	3
Norwood,	Edw. Cunningham,	20
Dedham,	Karlstein estate,	83
West Barnstable,	Howard Marston,	60
Norwell,	Nathan Cushing heirs,	15
North Andover,	Miss C. A. French,	45
Cohasset,	Mrs. Sarah Wheelwright,	20
Dedham,	Mrs. Harriet Rodman,	80

Cost. — In the above list seven of the operations will have been carried on at no loss or a small profit, and all but two at a net cost not greatly exceeding \$5 an acre. The other two contained so much brush that the cost was larger, but the owners felt well repaid.

Some cost data from the operation on Karlstein estate in Dedham follow. This operation is not quite finished at this writing, so the data are not absolutely complete. The work was done by a crew paid from \$2 to \$2.25 per day, under an experienced foreman. The men live in a camp provided on the estate. The conditions on the estate were as follows: the growth was mostly a medium hardwood stand, with about 75 per cent. oak and about 35 per cent. white oak, and with considerable pine reproduction in places. The moth infestation was severe, although as yet not more than 10 per cent. of the trees had been killed. The brush was not very heavy, but a fair amount had to be cut. The estate was being held for development, and the purpose of the thinning was to put it into shape so that a wooded condition could be maintained at the least possible expense. The general rule of the cutting was to cut practically all white oaks, all dead and inferior trees, and as many of all species of the other oaks as possible; to cut all brush necessary, to split and pile the wood in 4-foot lengths; to burn the brush and slashing, and to encourage the growth of the pine as much as possible.



A mixed growth of hard and soft wood that is sure to be destroyed by the gypsy moth unless the owner spends large sums of money in spraying and treating. The only practical forestry solution is to immediately cut out the hardwoods and give the whole area over to the white pine. In an infested stand like this the pines are killed outright in a year or two; therefore, owners having similar woodlands should give them early attention. The pine in clear stands by itself is perfectly resistant to the moths.



A severe thinning, to be followed by underplanting with white pine. The product, which was largely white oak, sold for enough to meet the expense. Gypsy moth suppression work on the Karlstein property at Dedham. This property was stripped the past season.

Cost Data of Operation on Karlstein Estate.

Cutting and piling, based on 82.5 acres; burning, based on 47.5 acres. Total cut: 539 cords of wood, 90 ties, 6,000 feet of pine. In working data this is called the equivalent of 565 cords.

	Per Cord.	Per Acre.	Total.
Wood and brush cutting, ¹	\$1 97	\$13 48	\$1,112 05
Brush piling,	15	1 00	83 00
Brush burning,	25	1 80	148 10 ²
Other expense, ³	04	25	21 00
Supervision, ⁴	15	1 01	84 00
Total,	\$2 56	\$17 55	\$1,448 15 ²

¹ Includes stacking wood. Brush cutting is estimated at about 8 per cent.

² Estimated.

³ Includes saw filing, scaling wood, etc.

⁴ Includes time spent by foreman in directing men and marking trees, when he was not actually engaged in productive work.

Other items of expense which are not included are the cost of a camp for the men and of tools which will not greatly exceed \$25 in this case.

In conclusion we would say that this department is anxious to get in touch with all the owners of infested woodland in the State, to give them advice and all the help possible in solving the woodland problem. This work cannot be carried on without the help of the owners, who are the parties most vitally affected.

FOREST MAPPING.

This summer a beginning was made in work we have long desired to attempt, namely, the making of an estimate of the acreage of forest of different types and sizes; and, in conjunction with this, work out a forest map on which is shown, so far as practicable, what the land is producing.

It is possible to hire, in the summer, forest school students who are cheap and efficient men for this purpose. The work was carried out under the direction of Mr. Harold Fay, one of the assistant foresters in the office, who had the assistance of four forestry students, picked men from as many forestry schools.

As it was not possible, with the means at hand, to cover the

entire State in one season, it was decided to attempt the work county by county, and this year Worcester County was chosen. This county has been covered, with the exception of a few towns.

The method of field work was an adaptation of a large-scale timber cruising system, which we felt gave a maximum amount of information for a minimum cost. Each man worked one town at a time alone, running lines one-half mile apart, by compass and pace, from one boundary to the other. Record was kept of the length of each type, and type boundaries were sketched, so far as practicable, in an especially arranged note book checked off in scale with the large maps, to which the data were easily transferred. These maps, the scale of which is 976 feet to 1 inch, are enlargements from the United States topographical sheets, and we hope will be the basis for permanent forest maps of each town in the State.

By means of symbols the rough proportion of different species of trees growing on the ground traversed is shown, and by numbers, their approximate size. A rough estimate of the percentage of stocking was made. The number of white pine per acre was estimated, to enable a more accurate estimate of this, the most valuable timber, and especially to give an idea of the acreage where the occurrence of scattered white pine gives a chance for converting inferior hardwood forests into pine, by so handling as to secure more pine reproduction. Areas of exceptional hazard for forest fires were located by symbols on the maps, as were wood lots infected in different degrees by the chestnut bark disease.

From this work we feel we shall have a very reliable estimate of the acreage of different types of forests of different age classes for the county as a whole, and a fairly reliable estimate so far as the unit towns are concerned. The completeness and accuracy of the maps depend largely upon whether the towns have much or little open land, and uniform or frequently changing forest types.

So far as we know no other State has begun to collect data which will allow so accurate an estimate of its present stand of timber, and of what is likely to be produced during future periods.

In addition to the maps, which also furnish the basis for acreage and timber estimates, a forest report was made for each town, giving a general account of the forest conditions, lumbering and woodworking industries, prevailing prices of timber and of unproductive land, the names of some of the principal land-owners, forest-fire conditions, and the extent of the chestnut bark disease.

The plan is to keep these maps and reports on file at the office, so that forest data will be available for reference whenever a private individual or the department contemplates forestry work in any town.

As a sample we reproduce herewith the map of Bolton, which town was worked by Mr. J. R. Simmons, together with his forest report on the town, and a summary of the acreage estimates compiled from the map.

In forest description of tracts shown on the map, the letters and symbols at the left represent "type;" these are followed by "size-class" figures, then the number of white pine trees per acre (a line drawn above the figures indicates when they are suppressed white pine reproduction). Following the white pine figures comes the estimated percentage of stocking, and last, symbols representing fire hazard, chestnut bark disease, etc., if there chance to be any.

Symbols showing occupation of the soil are arranged in the order of prominence of the type or species. Softwoods when equalling 10 per cent. or more of the stand, and hardwoods when equalling 20 per cent. or more, are shown if not more than three symbols representing occupation of the soil are used in all.

For key to symbols on the map, see the first two columns of acreage estimate table.

FOREST SURVEY ACREAGE ESTIMATES, TOWN OF BOLTON, MASS.,
NOVEMBER, 1913.

TYPE SYMBOL.	Size Class,	4, 4-3	3-4, 3	3-2, 2-3	2, 2-1	1-2, 1	Totals (Acres).
	Approximate Age, based on White Pine and Chestnut (Years),	1-12	13-25	26-40	41-60	61 plus	
	<i>Species.</i>						
A, . . .	White pine,	20	424	166	347	14	971
T, . . .	White pine and gray birch, .	100	188	-	-	-	288
B, . . .	Mixed hardwood and white pine,	-	161	50	28	44	283
A, . . .	Mixed softwood,	-	11	2	9	-	22
C, . . .	Chestnut,	-	128	527	383	55	1,093
D and E C,	Chestnut with oaks,	424	887	255	250	-	1,796
S, . . .	Gray birch,	44	112	-	-	-	156
E, . . .	Oaks,	150	419	155	153	-	877
F, . . .	Mixed hardwood, ¹	-	185	-	2	-	187
M, . . .	Red maple,	88	244	-	-	-	332
G, . . .	Maple swamp,	-	424	164	-	-	588
I, . . .	Pitch pine,	-	101	33	-	-	134
	TOTAL WOODLAND AREA,	826	3,284	1,352	1,152	113	6,727 ²
							Acres.
Total woodland area,							6,727
X—Agricultural,							4,373
O—Open pasture,							902
K—Brushy pasture,							211
V—Useless swamp,							94
Water,							30
							5,810 ³
Total area of town,							12,337 ⁴
⊗—Chestnut blight.							
▽—Fire hazard,							572 ⁴
P—Drainable swamp,							94
Scattered pine untyped,							1,143
Suppressed pine, reproduction,							1,154
Total acreage with white pine present,							3,861 ⁵

¹ In this table species growing in mixture have been proportioned and recorded in their own column as though of pure growth.

² 55 per cent. of town area.

³ 45 per cent. of town area.

⁴ 5 per cent. of town area.

⁵ 31 per cent. of town area; 57 per cent. of woodland area.

⁶ Total acreage of town was figured from map on page 39.

FOREST REPORT OF TOWN OF BOLTON.

BOLTON, MASS., November, 1913.

Bolton lies along the eastern border of Worcester County just north-east from the city of Clinton. The Boston & Maine Railroad cuts it at the southeastern and southwestern corners, and its best markets, outside of Clinton and Hudson, are Worcester, 15 miles, and Boston, 30 miles, distant. The chief industries are dairy and fruit farming. The town is essentially a farming community, there being but three small villages. The lack of trolley lines is compensated by good roads leading from the town to its markets.

Topography.

The topography is irregular with hills and valleys. The general trend is north and south, with the ridges frequently broken by brooks and gullies. Highest hills are 600 feet.

Soils.

Light sandy soil, generally fertile and fairly deep, having gravel, and some clay subsoil. Black soil in the swamps and on some farms where draining has been done. South of Bolton village, on the west side of the Berlin road, are about 75 acres of moist land, difficult of drainage but bearing good hay. Some parts of the maple swamp on the opposite side of the road could be cleared and drained for agriculture. On the hills the soil is good, quite free from rocks, and raises apples and peaches.

Woodland.

Proportion of wooded to cleared land one-third to two-thirds,¹ according to the report of the assessors to the commission on taxation of waste and forest lands. The general appearance of the country would make this estimate seem too low for forest land. A considerable amount of good high land has been recently cleared of birch and sprouts for fruit growing.

General condition of forest, good, especially in the pine, oak and hardwood types. There is a good layer of humus. Principal species are pine, chestnut and oak, in clear and mixed stands; ash and hickory are common in the mixture, and as roadside trees. Suppressed pine is common in the chestnut and oak types.

LUMBER AND WOODWORKING INDUSTRIES.

Saw Mills.

1. Century Mill, W. J. Webber, proprietor, Bolton, Mass., cuts chestnut and pine; 150 M during the last two years, mostly for box boards which are sent to Hudson, Mass. Stumpage, \$10 to \$14 per M. Box

¹ See figures in table compiled from map.

boards, F. O. B., Hudson, \$22. This is the only lumber mill in Bolton, and it is idle most of the time.

2. E. M. Walcott, Bolton Village, Mass., cuts about 200 cords of wood per year.

Land Owners.

The largest holdings are considerably under 200 acres, and very little land is for sale. Owners of over 60 acres are checked in the accompanying assessors' list.

Waste Land.

Not extensive in area. Confined to (a) a few acres along the Lancaster boundary, in swamp, burned oak and hard pine land; (b) a strip of old pasture in the northeast about three-quarters of a mile wide, some of which is brushy; and (c) a very small burned area along the Hudson boundary. Average price of waste land \$5 per acre.

The only person reported as having waste land for sale is Mr. Blanchard, of Blanchard & Gould; he is said to own two lots of 50 acres each, adjoining.

Fires and Fire Damage.

No recent fires reported, though some slash areas exist, offering considerable risk, located (a) along Bolton and Lancaster boundary, north of Bolton station on cut-over lands and sprout growth; and (b) some portions of the ridge southwest from Vaughn Hill in the northwest.

A small burn occurred three to five years ago near the Hudson road in the eastern corner of the town, and southeast from Long Hill, and entered some distance into a large chestnut and maple wood lot. The whole burn covered about 50 acres of sprout.

Chestnut Bark Disease.

The chestnut blight occurs in all parts of the town, the worst being in the western and northern portions. A very large area of chestnut north of the village appears, as yet, to be in fair condition, with probably not more than one infected tree to the acre. Some of the wood lot owners interviewed have made a practice of cutting for cordwood blighted trees only, and expressed the opinion that this scheme would probably become popular among owners of timber in Bolton.

REFORESTATION WORK.

The reforestation act passed in 1908 makes provision for any one owning waste land suitable for replanting to deed it over to the State, with the provision that the owner, his heirs or assignees may redeem it at any time within ten years by paying the actual cost of planting. This cost varies from \$7 to \$10 per acre, according to the size of the tract, accessibility and

age of stock used. There is also a section of the act which enables us to buy land at not over \$5 an acre, and not over 80 acres in one tract in any one year.

Under this act some 4,489 acres have been acquired, as the following list shows. Of these, about 1,000 acres are owned by the State outright with no redemption clause, the land having been bought at a price of from \$2.50 to \$5 per acre. Where land has been bought, it is the policy of the office to purchase adjoining land the following year in order that individual lots may be more readily handled. We have advocated the removal of the 80-acre limit, as the average cost of planting is much less on large lots, and it is also often cheaper to acquire a large lot than a number of small ones.

These tracts will increase much in demonstration value in the next few years, as it takes a plantation from five to ten years to reach a height where it will attract attention. Even now some of the older plantations set in 1909 have created an interest in forest planting.

This law seems to be meeting with the aims of those who first advocated it, as throughout the State there are many land-owners who would not sell their land outright or would not set it out themselves, but who are willing to have the work done by the State Forester. It is safe to say that not over 200 acres of the 5,000 and over would be restocked to-day had it not been for this act enabling the owners to turn their land over to the State to be planted.

This year we have planted 782 acres of land, while the work of filling in and replanting lots where loss was due to the last few years' drought has been pushed with vigor. During the winter months a number of old lots were cleared of brush which had grown up and was interfering with the trees set.

FOREST NURSERY.

This fall, on land of the State Farm at Bridgewater, which was prepared for a nursery, we transplanted over 500,000 two-year old seedlings, consisting of white pine, Scotch pine and white ash.

The work was done by inmates of the farm under direction of a foreman employed by this office. By using the farm labor



A splendid stand of large white pine with a relatively small mixture of hardwoods on the fine Rodman estate in Dedham. The pine tops show the ravages of the gypsy moth. A number of the large pines are past redemption. This whole estate is being thinned out at the present time. The hardwoods are being taken out, together with the dead pines. Had the hardwood been removed early all of the pines could have been saved.

in the nursery we shall be able to do much more transplanting than formerly. The State Farm officials, Superintendent Blackstone and Mr. Hunt, have aided us in every way possible, and another spring will have additional land cleared, so that we shall have about 10 acres in the nursery, and be able to do a large amount of spring transplanting, and also raise not only enough transplanted stock to do our entire planting work, but enough to supply other State institutions with these transplants instead of seedlings.

In our nursery at Amherst we have about 7,000,000 trees, about 1,500,000 of which are three and four year transplants suitable for our spring planting.

This year we supplied the Metropolitan Park Commission with 300,000 two-year white pine seedlings, the Metropolitan Water Board with 250,000 two-year white pine seedlings and 150,000 three-year Norway spruce seedlings, and a number of the commissions with smaller amounts, — a total of 734,000 supplied for use on State land, outside of land planted under the reforestation act, by this department.

STATE PLANTATIONS, 1913.

TOWN.	Acres.	Type of Land.	Variety planted.
Gardner, . . .	87	Cut and burned over, .	White pine, Norway spruce.
Rutland, . . .	55	Cut-over land, . . .	White pine.
Leverett, . . .	24	Cut and burned over, .	White pine.
Leverett, . . .	66	Cut and burned over, .	White pine, Norway spruce.
Shelburne, . . .	42½	Cut and burned over, .	White pine, Norway spruce.
Nantucket, . . .	83	Sandy plain, . . .	White and Scotch pine.
Westminster, . . .	80	Cut-over pasture, . . .	White pine, Norway spruce.
Spencer, . . .	80	Cut-over pasture, . . .	White pine, etc.
Spencer, . . .	80	Cut-over pasture, . . .	White pine, etc.
Lancaster, . . .	32¾	Cut-over light land, . . .	White pine.
Taunton, . . .	64	Cut-over sprout land, . .	White pine.
Boxford, . . .	10½	Run-out mowing, . . .	White pine and red pine.
Freetown, . . .	9	Cut-over land, . . .	White pine.
Boxford, . . .	24¾	Cut-over land, . . .	White pine.
North Andover, . . .	44	Cut-over land, . . .	White pine.
Total, . . .	782		

AMHERST NURSERY, 1913.

VARIETY.	Age (Years).	Number of Trees.
White pine seedlings,	1	3,000,000
White pine seedlings,	2	2,000,000
Red pine seedlings,	2	200,000
Norway spruce seedlings,	2	216,000
European larch seedlings,	2	66,000
White ash seedlings,	2	70,000
White pine transplants,	3	1,091,000
White pine transplants,	4	344,000
Red pine transplants,	3	21,000
Norway spruce transplants,	3	18,000
Total, . . . . .	. . .	7,026,000

HOPKINTON NURSERY, 1913.

White pine transplants,	5	25,000
White pine transplants,	3	40,000
Norway spruce transplants,	3	30,000
Total, . . . . .	. . .	95,000

BRIDGEWATER NURSERY, 1913.

White pine transplants,	3	400,000
Scotch pine transplants,	3	53,300
White ash transplants,	2	50,250
Total, . . . . .	. . .	503,550

PLANTING DONE UNDER THE ADVICE OF THIS OFFICE.¹

NAME.	Location.	Variety.	Number of Trees.
Metropolitan Park Commission, . .	Blue Hill Reservation,	White pine, . .	300,000
Metropolitan Water Board, . . .	Wachusett System, .	White pine, . .	250,000
Metropolitan Water Board, . . .	Sudbury System, .	Norway spruce, .	150,000
Wachusett Reservation Commis- sion.	Princeton, . . .	White pine, . .	20,000
Bristol County School of Agricul- ture.	Segreganset, . . .	White pine, . .	2,000
Norfolk State Hospital,	Norfolk,	White pine, hemlock, arbor vitæ.	12,000
			734,000

¹ Trees furnished by State Forester (Amherst Nursery).

Each year a résumé of the season's work has been published, but some may be interested in having a complete summary of the work done under the reforestation act; therefore we have included in this report the following tables classifying the lots by counties and towns. The number of the lot is a part of our record system, and roughly indicates the order in which they were taken over. Where this number appears in heavy type it indicates that the lot was purchased outright by the State, the clause in the deed giving the owner the right to redeem the lot at the end of ten years being omitted. All other lots are subject to the privilege of redemption.

SUMMARY OF LOTS TAKEN UNDER REFORESTATION ACT.

	Lots.	Acres.
Purchased outright without privilege of redemption, . . .	20	849
Purchased with privilege of redemption,	20	914
Deeded without cost and with redemption privilege, . . .	66	2,690
Deeded without cost and without redemption privilege, . .	2	36

COMPLETE LIST OF LOTS TAKEN UNDER THE REFORESTATION ACT (BY COUNTIES).

Lot No.	Town.	Acres.	Year planted.	Lot No.	Town.	Acres.	Year planted.
<i>Barnstable County.</i>				<i>Middlesex County — Con.</i>			
55	Dennis, . . .	20	1912	36	Shirley, . . .	18	1910
61	Harwich, . . .	15	1911	59	Shirley, . . .	19½	1911
18	Sandwich, . . .	14	1909	104	Groton, . . .	13	-
19	Sandwich, . . .	10	1911	105	Groton, . . .	4½	-
31	Sandwich, . . .	20	-	<i>Hampshire County.</i>			
34	Sandwich, . . .	52	1910	30	Belchertown, . .	10	1910
54	Wellfleet, . . .	6½	1912	23	Pelham, . . .	16	1909
62	Yarmouth, . . .	21	1911	24	Pelham, . . .	6	1909
106	Barnstable, . . .	17	-	<i>Nantucket County.</i>			
109	Barnstable, . . .	32	-	84	Nantucket, . . .	83	1913
<i>Middlesex County.</i>				<i>Norfolk County.</i>			
49	Carlisle, . . .	40	1910	74	Dover, . . .	13½	1912
50	Hopkinton, . . .	28	1912				
51	Hopkinton, . . .	80	1912				

Lot No.	TOWN.	Acres.	Year planted.	Lot No.	TOWN.	Acres.	Year planted.
	<i>Plymouth County.</i>				<i>Worcester County</i> <i>— Con.</i>		
10	Carver, . . .	5	1909	12	Spencer, . . .	23	1909
78	Duxbury, . . .	38½	1912	13	Spencer, . . .	5½	1909
48	Kingston, . . .	14	1910	43	Spencer, . . .	14	1910
60	Kingston, . . .	140	1911	90	Spencer, . . .	80	1913
70	Norwell, . . .	10	1912	91	Spencer, . . .	40	—
	<i>Worcester County.</i>			92	Spencer, . . .	80	1913
8	Ashburnham, . .	10	1909	6	Templeton, . . .	107	1909
9	Ashburnham, . .	66	1909	26	Templeton, . . .	60	1909
38	Ashburnham, . .	53½	1911	37	Templeton, . . .	50	1912
39	Ashburnham, . .	94	1911	1	Westminster, . .	40	1909
40	Ashburnham, . .	14	1911	2	Westminster, . .	40	1909
56	Ashburnham, . .	63	1911	14	Westminster, . .	92½	1909
71	Ashburnham, . .	8½	1912	15	Westminster, . .	36	1909
72	Ashburnham, . .	19	1912	16	Westminster, . .	39	1909
73	Barre, . . .	38	1912	87	Westminster, . .	80	1913
45	Brookfield, . . .	37	1910	88	Westminster, . .	80	—
47	Brookfield, . . .	70	1910	89	Westminster, . .	7	—
57	Fitchburg, . . .	27	1911	100	Westminster, . .	80	—
79	Gardner, . . .	87	1913	107	Gardner, . . .	16	—
27	Gardner, . . .	93	1909		<i>Essex County.</i>		
44	Holden, . . .	50	1910	7	Andover, . . .	40	1909
3	Hubbardston, . .	40	1909	90	Andover, . . .	44	1913
4	Hubbardston, . .	14	1909	96	Boxford, . . .	10½	1913
17	Hubbardston, . .	54	1909	98	Boxford, . . .	24½	1913
21	Hubbardston, . .	40	1909	25	Rowley, . . .	8½	1909
22	Hubbardston, . .	10	1909		<i>Bristol County.</i>		
42	Hubbardston, . .	108	1910	69	Attleborough, . .	24	1911
52	Hubbardston, . .	40	1911	97	Freetown, . . .	9	1913
53	Hubbardston, . .	34	1911	94	Taunton, . . .	64	1913
63	Lancaster, . . .	74	1911		<i>Franklin County.</i>		
66	Lancaster, . . .	8½	1911	67	Buckland, . . .	166	1911
93	Lancaster, . . .	32½	1913	69	Buckland, . . .	11	1911
75	Oakham, . . .	80	1912	101	Buckland, . . .	75	—
20	Paxton, . . .	55	1909	32	Colrain, . . .	52	1910
58	Paxton, . . .	45	1911	33	Colrain, . . .	169	1910
80	Rutland, . . .	55	1913	41	Colrain, . . .	80	1912
11	Spencer, . . .	35	1909				

Lot No.	Town.	Acres.	Year planted.	Lot No.	Town.	Acres.	Year planted.
<i>Franklin County — Con.</i>				<i>Franklin County — Con.</i>			
28	Colrain, . . .	80	1910	95	Warwick, . . .	27	1913
29	Colrain, . . .	80	1910	102	Warwick, . . .	30	-
64	Greenfield, . . .	4	1911	103	Warwick, . . .	29	-
65	Heath, . . .	41	-	108	Buckland, . . .	10	-
81	Leverett, . . .	24	1913	<i>Berkshire County.</i>			
82	Leverett, . . .	66	1913	76	Becket, . . .	10	1912
5	Montague, . . .	26	1909	35	Peru, . . .	68	1910
83	Shelburn, . . .	42½	1913	77	Peru, . . .	12	1912

FOREST MANAGEMENT WORK.

The established policy of making examinations of woodland property, either public or private, and of giving advice in connection with the proper management of the same has been continued. A list of these examinations follows:—

EXAMINATIONS.

OWNER.	Location of Property.	Area (Acres).
Irving Smith,	Ashburnham,	2,500
Worcester Park Board,	Worcester,	200
Concord Golf Club,	Concord,	85
John Gifford,	Sutton,	150
F. F. Baldwin,	Hopkinton,	300
Jas. Richardson,	North Leominster,	34
Fred'k Bailey,	Chelmsford,	24
W. E. Barton,	Foxborough,	60
L. T. Reed,	Cummington,	60
Miss F. Rogers,	Cummington,	40
Miss F. Rogers,	Cummington,	60
Miss F. Rogers,	Cummington,	20
Miss Julia Steere,	Cummington,	20
Miss Julia Steere,	Cummington,	15
Mr. Alfred Mellor,	Cummington,	175
J. Baldwin,	Marion,	50
Ira Hersey,	Foxborough,	75

OWNER.	Location of Property.	Area (Acres).
Miss E. Ferguson,	Cummington,	20
Mrs. B. V. How,	Dracut,	205
Park Board,	Walpole,	20
Canaan Line Company,	North Marlborough,	400
A. Harlow,	Cummington,	60
E. Drake,	Sharon,	5
Park Board,	Lynn,	2,800
W. T. Porter,	Dover,	50
Mr. E. Pettingill,	Cummington,	200
Farm and trade school,	Thompson Island,	15
Fish and Game Commission,	Wilbraham,	50
M. Farnsworth,	Shirley,	1
Taunton State Hospital,	Taunton,	50
E. P. Ripley,	Weston,	8
D. Hough,	Vineyard Haven,	40
Lakeville Sanatorium,	Middleborough,	75
Mixer Farm,	Hardwick,	30
Edith S. Price,	Topsfield,	25
State Sanatorium,	North Reading,	123
R. C. Robbins,	Hamilton,	3
Robbins Estate,	Tyringham,	500
W. G. Vinal,	Marshfield,	20
L. C. Wason,	Canton,	25
Watcha Club,	Martha's Vineyard,	500
G. E. Watson,	North Leverett,	200
Mr. Way,	South Sudbury,	20
Mrs. F. E. White,	North Brookfield,	13
Water Board,	Winchendon,	150
Moses Williams,	North Falmouth,	75
E. H. Alderman,	Chester,	50
Geo. Baker,	Concord,	30
W. C. Brown,	Concord Junction,	50
A. B. Cutler,	Dedham,	90
C. B. Cooley,	Granville,	25
C. S. Dana,	Weston,	12
C. H. Dana,	Buzzards Bay,	30
Ramage Paper Company,	Monroe Bridge,	612
Total, . . . . .	. . . . .	10,250

The above list contains 54 examinations covering an area of 10,250 acres, expense, paid by landowners, \$30.33.

The number of examinations made this year is six less than given in the last report. The area examined is, however, increased by 4,502 acres. Many examinations in the eastern part of the State that formerly came under this department have been turned over to the moth end of the work, so that both in number and area the work has shown a large increase during the past year. Examinations in chestnut woodlands affected with the bark disease have also been classified separately, and this too would tend to lower the number handled by this department.

SURVEYS.

The following is a list of the lots taken over for reforestation and for which surveys have been made. Maps in triplicate for these lots are on file at this office.

SURVEYS FOR PLANTATIONS.

OWNER.	Town.	Area (Acres).
E. P. Churchill,	Freetown,	9
F. D. Lewis,	Groton,	4
Mary F. Pierce,	Freetown,	70
F. B. Lewis,	Groton,	13
Geo. Davis,	Shelburne,	42
State lot,	Manchester,	7
H. Fiske,	Buckland,	75
H. Fiske,	Buckland,	10
E. Smith,	Barnstable,	7
E. Smith,	Barnstable,	17
F. H. Webster,	Warwick,	31
A. P. Webster,	Warwick,	28
H. S. Hodgman,	Montague,	26
H. C. Harrington,	Westminster,	80
H. C. Harrington,	Gardner,	16
Calvin Benson,	West Barnstable,	32
F. H. Rhea,	Boxford,	10
Total, . . . . .	. . . . .	477

The total surveyed area for which maps have been made and are on file is 2,380 acres.

Working Plans.

Besides the above surveys there have been made four others, and the necessary data collected with which to produce working plans. These working plans will be completed during the present winter. It is not necessary to work these plans out in colors, as has been done at times in the past, for it is thought that a plan of one color, inked in, will answer the purpose as well and also save both time and expense.

The properties for which brief working plans have been made are owned and located as follows:—

	Acres.
Mr. S. Mellor, Cummington,	175
Mr. W. A. Barton, Foxborough,	60
Mr. L. T. Reed, Cummington,	60
Mr. W. T. Porter, Dover,	50

There will also be brought together, as soon as time will permit, sufficient data with which to make up a working plan for the Lynn Woods. It is encouraging to state that this well-known tract of woods, which in the past has been more or less neglected, may and probably will in the near future receive some of the attention so much needed to place the woods in a proper condition. That the Lynn Woods at the present time are in poor shape is evident to the most casual observer. Insect enemies and fires have raised such havoc in them that much of their former value and beauty have been lost. With the exception of a small percentage that has been thinned and sprayed, nearly the entire area is badly in need of immediate attention. Thousands of cords of wood should be removed as soon as possible, especially a large number of such trees as are particularly susceptible to future stripping by moths. Dead and dying wood and much scrub growth should be removed, thereby materially decreasing the fire danger.

It is confidently hoped that the city will place at the disposal of its Lynn Woods commission and water board a sufficient yearly appropriation to permit of the carrying on the needed work along forestry lines which will insure the proper perpetuation of the tree growth.

The needed line of procedure for carrying out such a piece of woods-work has been set forth in two reports from this office and submitted to the chairman of the Lynn Woods commission.

Thinnings.

Six thinning operations along strict forestry lines have been undertaken the past few months, two of which are about completed. One of these, the W. T. Porter lot in Dover, Mass., containing 50 acres, was stocked with a stand of such nature as to make very careful work necessary in order not to injure much of the young growth. A large part of the area was heavily stocked with white and pitch pine of all ages up to eighty to ninety years, also pasture birch, large red and white oak, maple, ash, chestnut, etc., all growing in a very mixed manner. Since much of the area was badly moth-infested, nearly all of the white oaks were removed. Also all pitch pine and pasture birch were removed from the tract. All told, several thousand feet of white pine, pitch pine and oak were felled, besides about 200 cords of wood.

The logs brought the following prices on the lot: white pine, \$10, pitch pine, \$8 and oak, \$15 per thousand. The cordwood when sold should bring about \$3.50 per cord on the lot. Regardless of the fact that operations were necessarily expensive on account of the badly mixed nature of the growth, it is thought that on the larger part of the tract expenditure and returns will be about even.

Mellor Lot.

Operations of a thinning nature have been started recently on the 175-acre tract of Mr. Alfred Mellor, in Cummington, but will not be completed for some time. The area is stocked with a heavy growth of mixed hardwoods and conifers of good size. There is much to do on this piece of woodland property to place it in the condition desired by the owner. In certain places where trees have been cut and logged by the old methods there are, as is usually the case, quantities of slash left as a breeder for forest fires. Much of this will be cleaned up and burned this winter. The trees on the property are of such size that much of the work to be done in the future should be carried on at a profit to the owner, whose intention it is to do about one-tenth of the work each year. This is probably the first piece of woodland thinning ever carried on in Cummington. It is hoped others will follow Mr. Mellor's lead.

The Barton Lot.

A thinning operation is now being carried on in Foxborough on the 60-acre tract of Mr. W. A. Barton, the tract constituting the woodland surrounding Sunset Lake. This is an operation consisting of the thinning out of about 150 cords of wood in a heavily stocked medium growth of mixed hardwoods and pine. It is thought the cost to the owner will be slight. All of the cordwood has already been sold on the lot.

Taunton Hospital Lot.

The tree growth covering about 50 acres at the Taunton State Hospital has been partly marked for thinnings, and a crew of men are at present engaged in removing the marked trees. This piece of woods is moth-infested and contains a large number of slowly dying trees of good size. It is the intention of Mr. Goss, the superintendent, to gradually underplant the entire thinned area. The small trees needed are to be furnished from the State nursery.

Markings will be completed in the near future over the entire tract, and it is hoped the choppers will have the marked trees cut, slash burned and the area ready for underplanting by the spring of 1914. The choppers are men employed by the institution, and all wood cut is used there.

Reed Lot.

The W. A. Reed property of 60 acres in Cummington, containing a good growth of mixed hardwoods and conifers of various ages, has been marked for heavy thinnings, and the marked trees are to be removed if possible this winter. The cutting and hauling of the logs, of which there will be several thousand feet, will be done by a local contractor. The major part of the lumber will be used by the owner.

A certain portion of the area is open land, and suitable for planting. It is the owner's intention to have this area stocked gradually from year to year, and to carry on all work done under advice from this office.

Greenfield Lot.

The Greenfield Women's Club purchased a tract of land known as Temple Woods on a steep, rocky ledge east of the town for the purpose of preserving the timber thereon, as it is in a region used by the people of Greenfield as a park. The growth is of considerable size and age, and is made up of pine, oak, chestnut, hemlock and hickory. Owing to the thin and rocky soil, and also, in part, to a fire that had been through a portion of the tract some years ago, many of the trees were dead or in poor condition. It was thought best to cut this over-mature growth and thus thin the woods. The chopping was done by our own men, the hauling was let out to a farmer, and the lumber was sold in the log to a mill man in Greenfield. About four acres of open land were planted with young pines, and all slash and brush left after logging were piled and burned. About 50,000 feet of lumber and 35 cords of wood were cut. Owing to the rough and precipitous nature of the land, and the lack of snow during the logging season, the expense of the work was heavy, but the returns about balanced the outlay.

Thinnings on Mountain Tracts.

It is hoped that this year permission can be obtained from the owners of the woodland property, upon which some of the State observation stations are located, to allow a forester from this office to make certain markings of the trees thereon, with the object in view of having the observation men make cuttings during such time as they may have when weather is not suitable for observation work. Such operations would of course be carried on slowly, but much good could be accomplished in time at practically no expense.

There should be many owners desiring to have their woodlands thinned this coming year. The good accomplished by proper thinnings is very apparent. Fire danger is very materially reduced, while the woods are much more accessible. If infested with moths this danger is lessened, the trees left are in better growing condition, a better stand is assured, and, generally, thinned woods lose little of their value from an aesthetic point of view.

Maps.

There were completed during the past year 24 maps for the use of the State Fire Warden and his observers. Nearly every outlook station in the State was fitted out with a new table map and alidade for use in locating forest fires. These maps consist of the United States government topographical sheets placed together, upon which the town boundary lines were laid out. We are indebted to the Harbor and Land Commission for the use of the town boundary lines obtained by the commission from comparatively recent surveys.

A large line map was also made for use in fire work, and also several maps for the moth department. There is still a good amount of map work to be done as soon as time will permit.

A recent feature in connection with the survey work carried on by this department is the marking of all corners on State lots with a 3-foot section of steel pipe. These pipes and stones make corners that cannot be eliminated or injured by fire, and should last at least fifteen to twenty years. It is very essential that lot corners be so marked that any future trouble may be eliminated. It has been impossible to place these steel corners on any except recently surveyed lots on account of lack of time, but as fast as possible this year the re-marking will be attended to.

A summary of some of the work accomplished by the forest management branch of the department in the past few years is as follows:—

EXAMINATIONS.	Number.	Area (Acres).	EXAMINATIONS.	Number.	Area (Acres).
1904,	14	2,000	1909,	60	15,862
1905,	36	6,545	1910,	49	6,495
1906,	47	9,357	1911,	66	9,694
1907,	37	8,713	1912,	58	5,748
1908,	65	15,842	1913,	54	10,250

CHESTNUT BARK DISEASE.

We have been very solicitous in this State as to the effect of this malady upon our chestnut trees during the past few years. The bulletins published by the State Forester have



A mixed mature stand at Norwell, showing white oaks on the right over one hundred years old and white pine trees on the left about fifty years of age. This lot is being operated on account of the gypsy moth infestation. The white pine is worth ten times the oak; further, the pine is resistant in clear stands. This explains why white pine is popular in reforestation.

served to give the information necessary to identify the disease, and as far as we know, what to do for it.

Early last spring I took a trip to Pennsylvania and Washington, D. C., to ascertain the latest information regarding the chestnut bark disease. The State of Pennsylvania has had a special State commission and a large appropriation for this work. The Bureau of Plant Industry of the United States Department of Agriculture has also had an appropriation of \$80,000 a year from Congress, and has had experts in the field. This latter appropriation was made possible through the special interest taken by our Massachusetts senators, Messrs. Crane and Lodge. This trip resulted in my learning the latest methods in Pennsylvania, and in securing an appropriation of \$3,000 from the Bureau of Plant Industry as the government's contribution to the State in attempting some co-operative work.

This season's work was immediately inaugurated, and free assistance and advice were offered to any one in the State having chestnut growth. Mr. Murdoch, one of my assistants who had had previous experience in the work, was put into the field and later we secured the services of Mr. Roy G. Pierce, who has been in our employ since early in July. Mr. Pierce is a graduate of the University of Michigan School of Forestry, and later was connected with the United States Forest Service. Previous to coming to Massachusetts he was employed for a year by the Pennsylvania Blight Commission, coming to us, therefore, well recommended.

Discovery in Massachusetts.

The chestnut blight was not found in Massachusetts until 1909, at which time 4 cases were authentically reported. The evidence found later indicates its presence as early as 1905 or 1906. In the summer of 1911, as reported in our bulletin, it was found in 72 towns. Since that time the blight has been found in at least 200 towns and cities in the State, and it is very probable that it is now in every town and city where chestnut grows to any extent.

Examinations for Blight.

Up to July, 1911, the work consisted mainly of examination of woodlands for individual owners, and of general scouting to

ascertain the prevalence of the disease throughout the State. In 1911, 6 of these special examinations were made for the blight. This was increased to 28 in 1912, on 2,291 acres. During the past year the examinations have been increased by 174 on approximately 8,000 acres of land.

Educational Work.

Since Mr. Pierce's connection with the work we have been able to broaden out along several lines. The educational feature has been emphasized as being a very necessary part in the problem of bringing before our people the methods of handling chestnut woodlands affected by the bark disease.

The State Grange field meetings were attended at Waban, Billerica, Springfield, Greenwich Village, Berkshire Park, Colrain, Athol and Leominster. At each of these summer meetings specimens of the chestnut blight fungus were exhibited, and the manner of spread, the symptoms of the disease and its importance were shown to all those who were interested. The State Forester's bulletin on the "Chestnut Bark Disease" was generally distributed at these meetings.

Three of the largest fairs of the State representing the eastern, middle and western sections were attended, namely, at Brockton, Worcester and Great Barrington. At Brockton and Worcester, through the courtesy of the extension department of the Massachusetts Agricultural College, ample table and wall space was secured for an excellent exhibit of logs from blight-killed chestnut trees, also specimens of bark from thin and thick barked trees, showing the characteristic appearance of the blight canker or blister on the former and the reddish brown pustules of the fungus in the cracks of the latter. Photographs, bulletins and charts were also displayed. Hundreds of wood-lot owners stopped for advice and to ask questions regarding the blight. Mr. Pierce gave a paper before the Massachusetts Tree Wardens' and Foresters' Association in Boston on August 22. Addresses were also given before the granges or local organizations at Montgomery, Blandford, Granville, Palmer and Brimfield, and before two classes at the Framingham Normal School.

Numerous press notices have appeared in the papers regard-

ing the chestnut blight work in the State. Without this help from the press the people could not have been reached in the way they have been. The results of this educational work have been encouraging.

During the season this department has begun some effective forest-mapping work, as noted elsewhere in this report, and this offered an exceptional opportunity to systematically determine the chestnut-blight conditions. A brief description of the infestations as found in the following towns may prove of interest: —

Auburn. — The chestnut blight has not made much headway in Auburn as yet. A number of isolated cases were found, but nothing threatening great damage at present.

Blackstone. — The per cent. of timber land covered with chestnut comprises at least one-half of the total, and probably two-thirds has some chestnut on it. The bark disease, although present in nearly all extensive stands of chestnut, seldom exceeds one affected tree per acre. West of the Mendon Road, near the Mendon-Blackstone line and in the extreme north-western corner of the town, are large tracts with 5 or more infections per acre, these being the worst cases of the disease in the town.

Douglas. — Chestnut bark disease scattered. Only individual trees attacked throughout the town. More prevalent in northern half, and usually among smaller growth. Chiefly noticeable around East Douglas.

Dudley. — In the timber along the western part of the town the chestnut bark disease occurs, but not very widely distributed. In young sprout stands, of which there are large areas, it is practically everywhere. There is very little evidence of its presence in the larger chestnut area in the eastern part of the town.

Grafton. — Chestnut constitutes practically 70 per cent. of the woods. Blight infections in stands 10 inches and over in diameter will not average more than 2 or 3 to the acre. Some of the stands are entirely free from it. In young sprout areas the disease is spread much more, in most cases about 10 to 15 young trees to the acre being infected. Some 200 acres of young sprout land, north of Goddard Pond, between the rail-

road and the road to the north, is pretty generally infected. The disease is found throughout the entire town, but is far more prevalent on the younger trees.

Northbridge. — The chestnut blight has badly infected young chestnut sprout lands, much of which occurs in this town. Almost every plot of young chestnut contains infected trees. In the western part of the town, in the woods of larger trees, the blight is not very prevalent. It occurs scatteringly in practically all chestnut woods in the eastern part of the town.

Sutton. — The chestnut blight occurs practically everywhere in the young sprout lands. The older trees as yet do not show the effects. In one place, situated about midway up the eastern boundary of the town it has killed every tree, and at present is spreading fast in all directions.

This chestnut bark disease work the State Forester has organized for purposes of economic effectiveness, as follows: The assistant in immediate charge, who is an expert, is given a definite policy to carry out. The expert, Mr. Pierce in this case, is then authorized to enlist the assistance of the regular staff of this organization as a large auxiliary body of men to report their observations as they travel about the State. This necessitates the acquaintance of the men with the disease. Co-operation in this way increases the amount of good the department may do; also broadens and develops our employees for greater usefulness.

Besides the assistants and division men, forest wardens, moth superintendents and patrolmen are all included.

Recommendations.

Studies made throughout the State show that the younger thin-barked chestnut sprouts have become affected by the chestnut bark disease to a much higher per cent. than older stands of thick-barked trees; that is, while the younger trees are often infected from 25 to 100 per cent., the older trees near by would show infection from only 1 to 10 per cent.

While it is possible by removal of blight cankers and diseased limbs on valuable lawn and park trees, or on grafted nut trees, to prolong the life of chestnut trees affected by the bark disease, yet this sort of treatment is not applicable to forest trees. Wherever the chestnut blight has affected the trees in the forest,

the only treatment possible to check the disease is the prompt removal of the infected trees. This is specially advised where the diseased trees are large enough to produce valuable products, as poles, ties, posts and cordwood.

The removal of all near-by sources of infection will render the timber less liable to be infected in the future, since the blight seems to spread faster from local centers to near-by trees than to trees at a distance.

Better forest practice is needed in combating this disease. The general practice has been to clean-cut the chestnut and oak stands in southern New England without intermediate thinnings. This has often been wasteful. The trees which make up the dominant growth in forty or fifty year old stands have had to fight for light, food and moisture at the expense of the weaker trees. Proper thinnings would tend to reduce the fierce competition, give an intermediate yield, as well as cut down the time at which the trees would reach a merchantable size. The experiments of European foresters have shown that the rotation of the timber crop can be shortened by judicious thinnings from 10 to 20 per cent.

Since it seems that the smaller chestnut trees in Massachusetts are liable to be infected by the chestnut bark fungus to a greater extent than larger trees, it may be concluded that the faster the small trees can be made to grow, the quicker will they become more resistant to the disease. The rate of diameter growth may be very materially increased by proper thinnings.

As heretofore, this department stands ready to advise any owners of chestnut growth, as to its present and future management, at no expense. It is more satisfactory to both parties where the owner goes over the woodlands personally with the expert. For examinations, make application to this office.

REPORT OF THE STATE FIRE WARDEN.

MR. F. W. RANE, *State Forester*.

SIR: — In compliance with your request, and in accord with the provisions of chapter 722, section 2, Acts of 1911, I beg to submit the following report of the work accomplished by this branch of the department this year: —

The same division of the State has been continued again this year as follows: District No. 1, Essex, Middlesex and Norfolk counties; District

No. 2, Barnstable, Bristol and Plymouth counties; District No. 3, Worcester County and west to the Connecticut River; District No. 4, Berkshire County and east to the Connecticut River. Each district is under the supervision of a district forest warden. Two changes have been made in the personnel of the district forest wardens. Mr. James E. Moloy, who has had supervision of District No. 1, was made inspector of locomotives, being succeeded by Mr. Oscar L. Noyes. Mr. Albert R. Ordway has been appointed district warden of the 4th district to succeed Mr. Frank L. Haynes, who has been promoted to the position of assistant forester, assisting in the forest management work.

The district forest wardens have full supervision of the work in their districts, being in charge of the several observation stations, as well as constructing telephone lines, erecting steel towers, map-making, visiting each town and consulting with the selectmen and town forest wardens and deputies relative to the need of additional equipment for handling fires, and perfecting better forest fire-fighting organizations. This may seem a very easy matter, but when we take into consideration that we have 354 towns and cities, and that the matter of purchasing equipment must be brought before the citizens at their annual or special town meetings, it means an immense amount of work.

In the work of perfecting town forest fire-fighting organizations we have been handicapped owing to the appointment of 354 town and city forest wardens being made by the selectmen of as many towns, this department simply having the approval of them. The result is that we still have inefficient men in some towns, — men who are not interested in the preservation of the forests and who know little, if anything, about handling forest fires. This should be remedied by these appointments being made by this department, thus making the department responsible for the results. We should then have efficient men in every town.

We have had in operation this year 21 observation stations reporting to the town forest wardens 3,238 fires.

District No. 1. — In addition to the four observation towers already established in this district we have erected and equipped two 40-foot steel towers. One of these is located in the town of Essex on Morse Hill, which covers all of Cape Ann, as well as all the valuable timber land along the North Shore. We are deeply indebted to Col. Wm. D. Sohier, chairman of the North Shore summer residents committee, for his liberal contribution of \$900 toward the tower and 7 acres of land which were acquired and donated to the Commonwealth. This tower was completed April 24 and used throughout the season. The second tower was built on Hart Hill in the town of Wakefield, this hill being a part of the city reservation and making an ideal location for a tower. The town of Wakefield contributed \$350 toward this tower.

It is very important that a tower be placed on Nobscot Hill in the town of Framingham during the coming year, in order to assist several towns that are now receiving no protection. These unprotected towns will

contribute liberally toward such a tower, which will complete the observation system in District No. 1.

District No. 2. — Two new 40-foot towers have been established in this district, one at North Hanson and one at Bournedale. The North Hanson tower is located on Bonney Hill and commands an excellent view. The towns of Duxbury, Hanson, Hanover, Halifax, Pembroke, Plympton, Marshfield and Whitman contributed \$725 toward the purchase of this tower. The Bournedale tower, located near the Bourne and Plymouth line, covers a large tract of valuable forest land, as well as many acres of burned-over areas in the towns of Bourne and Sandwich. The towns of Bourne and Wareham contributed \$450 toward the erection of this tower. This burned area should be reforested, and with the protection derived from this tower and the hearty co-operation of the citizens of these towns, there should be very little danger of any such fire as experienced there this year.

Three other stations should be established in this district in order to completely cover it, located at Falmouth, Harwich and Fall River. The officials of these towns have expressed a desire to contribute very liberally if towers are located there. It is expected that the citizens of Barnstable and Yarmouth will purchase a new steel tower to replace the old wooden one now in use at Shoot Flying Hill. Owing to the unsafe condition of the old tower during heavy winds that prevail in that locality, and to the many visitors who frequent this tower, it is extremely necessary that a new tower be erected. The citizens of Middleborough, Lakeville and Carver are contemplating the establishment of a tower on Bardons Hill in Middleborough, which will cover these towns as well as other surrounding towns. We have used the town hall at Middleborough this year, but have not been able to obtain nearly as good results as would have been obtained from Bardons Hill. With these extra towers we shall be able to protect all the forest area in this district.

District No. 3. — Two temporary stations have been added in this district this year, — one on little Muggett Hill in Charlton, which was used two months during the spring, and one on Lincoln Mountain, in Pelham. An old wooden tower was repaired and used at this latter station throughout the season. Several influential citizens of Amherst and surrounding towns have signified their desire to contribute liberally toward installing a steel tower at this point. It is necessary that the northern and southern portions of this district be better protected by the addition of at least two more stations, but as no co-operative agreement is in operation between this State and the States of New Hampshire and Connecticut, it is not advisable to erect such towers until some satisfactory agreement can be reached relative to the proportionate charge for maintenance to be paid by the above States.

District No. 4. — Owing to the discontinuance of the use of Greylock Mountain as an observation station, it has been necessary to build a temporary tower in the trees on Tower Mountain in Savoy, which was

used a portion of the season. It is necessary that three new stations be established in this district along the boundary lines of Vermont, New York and Connecticut, but the same consideration arises as to the future maintenance as in District No. 3. It is hoped that some definite agreement may be reached at once with the federal department and with adjoining States which will permit the establishing of these stations, thereby completing our observation system.

Owing to the large number of people visiting our observation stations it has been found advisable, from an educational standpoint, to provide better means for reaching the observation rooms, so that they may be made accessible to women and elderly people. With this point in view, and with the generous contributions made by the different towns, we have equipped all our towers purchased this year with spiral or fire-escape stairs, with two landings before reaching the top. From the reports received from our observers it is surprising to note that we have had nearly 3,000 people visit our towers this season, representing nearly every State in the Union and many of the foreign countries.

FOREST FIRE EQUIPMENT.

Under an act of the Legislature passed in the spring of 1910, appropriating \$5,000 annually for forest fire protection, towns with a valuation of \$1,500,000 or less are entitled to 50 per cent. reimbursement on all forest fire-fighting equipment they desire to purchase not exceeding \$500, no town being allowed an amount exceeding \$250. All forest fire equipment purchased under this act is approved by this department and placed under the supervision of the town forest warden, subject to inspection at all times by the State Fire Warden or the district forest wardens.

We have at the present time 156 towns coming within the provisions of this act, and during the four years it has been in operation 108 towns have taken advantage of it. This year 53 towns have exhausted the appropriation. Until this year it has been extremely difficult to impress upon the citizens of the central and western parts of the State the importance of providing their towns with proper equipment, but of this year's appropriation, over \$3,000 was expended in Districts Nos. 3 and 4. The style of equipment desired varies in the different parts of the State. Throughout the eastern part fire extinguishers work to exceptionally good advantage in checking any ordinary fire, but in the western hilly country it is extremely difficult to convince the public that they can be used to good advantage at such fires, many preferring the old method of using shovels and dirt. These towns expend very little money for equipment of any nature; consequently, out of 56 towns west of the Connecticut River that are entitled to reimbursement but 18 have taken advantage of the act.

There are at the present time 198 towns whose valuation exceeds \$1,500,000, and that are, therefore, not entitled to reimbursement. Sev-

eral of these towns have purchased equipment this year, thereby better protecting themselves from the ravages of the fire evil. In 1910, when the reimbursement law was enacted, there were 178 towns coming under the act. During the past four years the valuation of 22 of them has increased so that it now exceeds \$1,500,000, and they are no longer entitled to reimbursement. Owing to no special effort being made by this department along this line until the past two years, it seems but fair that the law be amended, making the valuation limit \$1,750,000, thereby allowing these 22 towns to take advantage of the act. The following tables on pages 69 to 72, show, first, an itemized statement of the equipment purchased since the enactment of the law and the amount received by each town from the Commonwealth during that period; second, a list of the towns having purchased equipment *this year* and the amount of reimbursement received by them. This department holds receipts from the town forest wardens for all equipment purchased under the act.

RAILROAD FIRES.

The railroad fire situation is gradually improving, but owing to the fact that there are over 2,000 locomotives, and over 2,500 miles of right of way within this State, it is very evident that a vast amount of work must be done to eliminate railroad fires. In addition to the above we have the many miles of slash accumulation adjoining the right of way where owners seem indifferent, preferring in many instances to allow the burning of it by sparks from locomotives, whereby they may get a fair revenue in the form of damage claims, rather than to dispose of it themselves and thereby eliminate the danger of fires during severe drought.

Through the courtesy of the Board of Railroad Commissioners and the consent of the railroad officials this department has been able to maintain a system of locomotive inspections, one inspector being detailed on this line of work and vested with authority to inspect the spark arresters and ash pans of locomotives in operation throughout the State. In addition to this, the New York Conservation Commission has inspected all locomotives running into New York State, thus improving the condition of locomotives used in the western part of Massachusetts. Our records show that 1,105 locomotives were inspected, of which 26 per cent. of the Boston & Albany locomotives, 23 per cent. of the Boston & Maine locomotives, and 49 per cent. of the New York, New Haven & Hartford locomotives were defective. A large percentage of the defective locomotives were found in the early part of the season. As the season advanced, and extra men were assigned to repairing the defects and installing new screens where necessary, inspections showed a very decided improvement, very few defective locomotives being found. As this inspection work is most important; it is necessary that at least one more inspector be employed this coming season.

Mr. E. A. Ryder, who has charge of the fire prevention department of

the Boston & Maine Railroad, is certainly deserving of a great deal of credit for his excellent record in reducing the fire claims of that road in the past two years. From a loss of \$200,000 in 1911 to one of less than \$50,000 this year is certainly very commendable, especially so when we take into consideration the continuous drought that was experienced in this State this year, producing a condition for fires almost unprecedented. In order that still better results may be obtained, this road is equipping all locomotives running over the Central Massachusetts division with the Mudge-Slater spark arrester, a device which has been used with great success on the Chicago & Northwestern Railroad in the west and on the Maine Central Railroad in the east. They are also to maintain a patrol service along dangerous sections, patrolmen being provided with gasoline speeder cars which will accommodate two men and the necessary equipment for their use.

The results accomplished by the New York, New Haven & Hartford Railroad have not been as satisfactory as was desired. Little attention was paid to defective spark arresters until the matter was called to the attention of the vice-president of the road, showing the vast amount of money expended by the road for settling fire claims and extinguishing fires, and that little or nothing was being done to remedy the cause of these fires. Orders were at once issued requiring that special attention be paid to all spark arresters and ash pans, and inspections made late in the season showed a very decided improvement.

Our railroad fire reports show that we have had 913 railroad fires, as follows: Central Vermont, 65; Boston & Albany, 151; Boston & Maine, 232; New York, New Haven & Hartford, 465; burning over an area of 16,620 acres, with a cost to extinguish of \$8,930 and a damage of \$64,222.

Owing to the large number of fires throughout the Cape country, the greater per cent. of which were caused by locomotives, the Public Service Commission was petitioned, under date of August 19, as follows: —

To the Public Service Commission:

Respectfully represents F. William Rane, as he is State Forester, that in that part of the Commonwealth comprising Barnstable County there have been for many years past a very large number of fires set in the grass lands and woodlands by sparks from locomotives operated by the New York, New Haven & Hartford Railroad Company; that many of these fires have burned over large areas of woodlands and destroyed large quantities of wood, both cut wood and standing wood, and fires spreading from these fires in the woodlands have burned and destroyed dwellings and other buildings; that many complaints from private citizens residing in the different villages and towns in said county have been made to him, as State Forester, all calling attention to the large number of fires that have been set by sparks from locomotives; that your petitioner has repeatedly called the attention of the officials of said railroad to the above conditions, and said officials have, by the installation of spark arresters on the locomotives, and by clearing up and burning the grass within the locations, sought to prevent the escape of sparks from the locomotives and the starting of fires, but the number of fires has increased rather than decreased; that a careful investigation has been made and the following appear to be the conditions throughout the entire county, from Buzzards Bay to Prov-

incetown, from Bussards Bay to Woods Hole, from Yarmouth to Hyannis, and from Harwich to Chatham, to wit: there is only a single track on the main line and the above branches, with sidings at the different stations; that the roadbed over its entire length is of very uneven and varying grades; that there are operated daily a large number of trains, both freight and passenger; that because of said different grades, and because of there being but a single track, there is necessity of making the schedules so that the trains may meet and pass at the meeting points; that the locomotives of necessity in many instances have to be run at forced draft, and therefore many sparks are emitted from them and many fires are thereby set; that during the past summer months a very large number of fires have occurred, and reports and complaints are being daily received by the State Forester of the numerous fires that are being set, both within and adjoining the railroad location, by sparks from the locomotives, which fires spread over the adjoining lands of private owners; that in consequence of these many fires many of the communities are in comparative fear of fires and of the damage resulting from them; that while the number of fires has been very great during the immediate past two months, owing probably to the unusual dryness of vegetation, yet during all the year, when conditions are normal, an unusually large number of fires are set in this county by sparks from locomotives; that the railroad company has made an effort to reduce the number of fires by clearing up its right of way and by equipping engines with spark arresters, but the dryness of the vegetation and the unevenness of the roadbed, requiring heavy firing of the locomotives at many parts of the system in this county, has resulted in causing a large number of fires to be set (for example, it is reported from the village of Barnstable that in a distance of less than 2 miles 11 fires were started on Saturday, August 16, an actual count of burned places within and just outside the railroad location, between the railroad stations at West Barnstable and Barnstable, a distance of 4 miles, shows that a total number of 70 fires have already been set during the present summer, and a casual observation while riding on the train shows that a very large number of fires have been set within and adjoining the railroad location throughout the whole length of the line in said county); that your petitioner, in his capacity as State Forester, acting under the authority of acts of the different Legislatures, has been for several years establishing nurseries and plantations in different parts of the Commonwealth for the growing of trees, and has set out in various parts of Barnstable County plantations of trees, all of which is being done both to create a new growth of trees and also to encourage among private individuals the further growth of timber growing within the Commonwealth and in that county; that in consequence of the many fires which have been set by sparks from locomotives and from other causes, the nurseries and plantations of trees have been seriously menaced; that further introduction has been retarded and private individuals have hesitated to engage in forestry work; that a careful investigation of the conditions has convinced your petitioner that the only remedy for preventing the setting of the large number of fires is by a change of means of operating the engines of the New York, New Haven & Hartford Railroad Company from the present coal-burning fuel engines to either the electrification of that part of the New York, New Haven & Hartford Railroad system which it operates in Barnstable County, or by equipping the present engines, now equipped to burn coal only, with such devices as will allow the burning of oil; that the electrification of that part of the line of said railroad, while it would permanently prevent a recurrence of the present conditions, yet seems to be impracticable at the present time because of the cost of installing such a system; that the use of oil-burning engines in other parts of the United States, where railroad locations run through forest and woodlands, has shown that the use of such oil-burning engines has resulted in practically an entire stopping of fires.

Wherefore, your petitioner respectfully prays that your honorable board may determine that only engines equipped with oil-burning devices shall be operated

by said railroad company in Barnstable County, and will make an order requiring said railroad company to forthwith so equip its engines for use in said county with oil-burning devices, and operate only such engines in said county.

In response to the above petition the following order was issued:—

It is

Ordered, That a copy of this petition be sent to the New York, New Haven & Hartford Railroad Company with the request that it make report as to the feasibility of substituting oil for coal, particularly in the Cape district; also as to the comparative cost of the two methods of supplying fuel for the engines, including also consideration of economics by reason of saving in damage claims for forest fires set.

It is further

Ordered, That the petition stand for public hearing on Sept. 22, 1913, at 10.30 o'clock in the forenoon, to be duly advertised.

Attest:

(Signed)

ALLAN BROOKS,
Assistant Secretary.

The State Forester's department was represented at this hearing by Deputy Attorney-General Henry M. Hutchings, acting attorney for this department. Nearly 100 residents and property owners residing in Barnstable County were in attendance, including the Hon. Thos. C. Thatcher, who made the trip from Washington especially to be heard on this matter, Wm. C. Adams, representing the Fish and Game Commission, Chas. C. Craig, representing boards of trade of Falmouth and Cape Cod, delegates from many granges, and members of the boards of selectmen of every town in Barnstable County. A whole day was devoted to the discussion, at the conclusion of which the chairman of the Public Service Commission stated publicly that it had been proven to the satisfaction of the commission that the forest-fire situation along the railroad was critical. At the conclusion of the hearing a statement was filed with the railroad requiring certain information relative to the present operating expenses of the road within Barnstable County. Upon receipt of this information a second hearing is to be called at which expert testimony will be introduced showing the approximate cost of burning oil as compared with the present expense of operation.

RURAL MAIL CARRIERS.

The results obtained from the co-operation with the 300 rural mail carriers within the State were not as satisfactory as we had expected, this being undoubtedly due to the fact that this department is not in direct touch with the carriers, all instructions from this office being submitted to the postmasters. During the last of the season we deviated somewhat from this plan and requested our district wardens to personally call on the carriers, whenever an opportunity presented itself, and interest them in this line of work. These interviews have already shown results, and I feel that when we are able to get in touch with all the carriers greatly improved results will be shown. Our reports from the postmasters show

that 144 fires were reported by the carriers during the year. This number would undoubtedly have been very materially increased if reports had been received direct from the carriers.

FEDERAL CO-OPERATION.

The Weeks bill passed in 1910, providing for the purchase of portions of the White Mountain and Appalachian Mountain regions, also provides for the protection against fires of watersheds of navigable streams in the United States. The co-operative work in this State is confined to the watersheds of the Nashua, Chicopee, Miller, Thames, Blackstone, Hudson, Connecticut and Deerfield rivers, and an allotment of \$3,000 was made by the federal department for carrying on the work within these watersheds. This fund was used for the payment of observers in the various observation towers throughout the central and western parts of the State. This appropriation has made it possible to better protect the above watersheds than would have been possible under our limited State appropriation.

DANGER FROM SLASH.

The greatest fire evil this department has to contend with is the slash problem. It is impossible even to give an estimate of the number of the thousands of acres of slash there are left upon the ground throughout the State at the present time, but some idea may be reached when we take into consideration that there are 297 portable sawmills in operation, and in only 12 instances has there been any disposition made of the slash. We also have over 300 miles of power line, a large percentage of which runs through forest lands. These lines are cut, in most instances, 150 feet wide, and in nearly every case the slash is piled against the adjoining forest area. These power lines would make excellent fire lines, provided they were cleaned and the brush disposed of.

Then we have the many miles of highway where not only do we have the accumulation of slash on property adjoining the highway, but the land within the road limits is not cleaned in many instances. If this were cleaned the many fires starting from automobile parties and others carelessly throwing lighted matches, cigars and cigarettes along the roadside would be lessened very materially. The time is certainly at hand when legislation should be enacted that will improve the slash conditions throughout the State and put a stop to the enormous damage from fires from this cause.

BOY SCOUTS.

The following communication from Scout Commissioner Ormond E. Loomis of the Greater Boston District gives a very good idea of the interest shown by the Boy Scout organization in the prevention of forest fires.

Mr. M. C. HUTCHINS, State Fire Warden, 6 Beacon Street, Boston, Mass.

DEAR SIR: — Complying with your request that we submit a report showing to what extent the Boy Scouts in Massachusetts have benefited the State by

checking or stopping forest or brush fires, I am glad to send you herewith the very meager information given me. This is accurate for Greater Boston alone, as our office has supervision only over scouts in the towns of Greater Boston, that is, those in towns within a 10-mile radius of the State House.

Scouts in this territory have discovered and reported many small brush fires in sections of our State reserve and in large wooded estates in the vicinity of Boston, especially in Milton, Quincy and Braintree districts and the Waltham, Medford, Lexington and Wakefield districts. Through your State officials and fire wardens in the various outlying districts you have doubtless already heard of the work done near Falmouth, Gardner and Fitchburg, and that done out in the Berkshire Hills. Of these I have only the general newspaper reports.

Special groups of scouts in smaller towns have patrolled dangerous sections near railroad tracks during the extra dry season of the summer. They were probably instrumental in locating several small fires that might have been seriously damaging, but it is difficult to say accurately just how much value their services were. Numerous instances have come to my attention in which boys have stopped grass fires, but in most cases these were considered by them so unimportant that no special reports were made.

It is my belief that much more has been done during the year in the way of prevention than by actual work in stopping fires already started. The bulletins furnished by you to our scout officials have done more than any other one thing to instruct them as to what the law in Massachusetts, regarding the lighting of fires, is, and to indicate to them what they should do whenever they observe a fire. The information contained in the pamphlet has been freely disseminated so that scouts also are now fairly well informed as to what they should and should not do when traveling afield. Perhaps it is safe to assume that their knowledge and caution has had a good influence on others who might have committed offences and upon those who, because of lassitude or indifference, were slow to inform the State authorities that offences were being committed.

In the interests of further safety and instruction I should like very much to have a new supply of pamphlets to distribute to those who have become scout masters since your first distribution of the information bulletins.

Appreciating your kindly interest in the work of the scouts and your desire to educate them in their duties as future citizens of the Commonwealth, I am

Sincerely yours,

ORMOND E. LOOMIS,
Scout Commissioner.

INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT ACT.

Town.	Axes.	Cans.	Extinguishers.	Hoses.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reimbursement.
Acushnet, . . .	1	10	16	-	-	-	4	1	-	-	-	1 ¹	\$143 22
Ashburnham, . . .	-	-	8	-	-	-	-	-	-	-	-	-	25 00
Ashby, . . .	-	-	12	-	-	-	-	-	-	-	-	-	34 50
Ashfield, . . .	-	-	33	-	-	-	-	-	-	-	-	-	99 00
Ashland, . . .	-	6	10	-	-	-	12	6	-	6	12	-	77 31
Auburn, . . .	-	-	83	-	-	-	-	-	-	-	-	-	249 00
Avon, . . .	-	10	-	-	-	-	12	-	-	-	-	-	9 90
Becket, . . .	-	4	6	-	-	-	-	-	-	-	12	-	28 35
Bedford, . . .	1	14	24	-	-	-	-	-	-	-	-	1 ²	249 67
Belchertown, . . .	-	-	39	-	-	-	-	-	-	-	-	-	171 62
Bellingham, . . .	-	16	20	-	-	-	6	-	-	8	-	1 ¹	113 17
Berkley, . . .	-	-	24	-	-	-	-	-	-	-	-	-	144 00
Berlin, . . .	2	10	38	-	-	1	12	-	3	12	-	1 ¹	241 45
Blandford, . . .	-	1	16	-	-	-	-	-	-	-	-	-	59 80
Bolton, . . .	-	14	12	-	-	-	6	-	-	6	-	-	58 40
Boxborough, . . .	1	-	30	-	-	2	-	-	3	4	-	1 ¹	180 46
Roxford, . . .	-	-	16	-	-	-	-	-	-	-	-	-	45 60
Boylston, . . .	-	-	24	-	-	-	-	-	-	-	-	-	76 30
Brimfield, . . .	-	10	30	-	-	-	-	-	-	-	-	-	99 75
Burlington, . . .	-	-	20	-	-	-	-	-	-	-	-	-	100 00
Carlisle, . . .	2	15	18	-	2	-	6	-	1	6	-	1 ²	247 72
Charlton, . . .	-	-	68	-	-	-	40	-	-	60	-	-	321 37
Chatham, . . .	2	15	10	-	2	3	4	-	3	5	-	1 ¹	152 98
Chesterfield, . . .	-	-	25	-	-	-	-	-	-	-	-	-	75 00
Dana, . . .	-	-	6	-	-	-	-	-	-	-	-	-	18 75
Dighton, . . .	2	8	18	-	1	-	-	-	2	2	-	1 ¹	108 67
Douglas, . . .	-	25	50	-	-	-	-	-	-	-	-	-	175 00
Dunstable, . . .	2	25	10	-	1	-	4	-	3	6	6	1 ¹	106 14
East Longmeadow, . . .	2	-	18	-	2	-	12	-	-	4	-	1 ¹	149 71
Erving, . . .	-	-	25	30	-	-	-	-	-	18	-	-	86 52
Freetown, . . .	-	24	20	-	-	-	-	2	-	72	-	-	166 58
Georgetown, . . .	-	20	36	-	-	-	-	-	6	12	-	-	134 83
Gill, . . .	-	5	20	-	-	-	-	-	-	-	-	-	65 00
Goshen, . . .	-	-	25	-	-	-	-	-	-	-	-	-	121 73

¹ One-horse.² Two-horse.

**INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT
ACT—Continued.**

Town.	Axes.	Cans.	Extinguishers.	Hoses.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reim- burse- ment.
Granby, . . .	-	-	12	-	-	-	-	-	-	-	-	-	\$39 00
Granville, . . .	-	-	-	-	-	-	-	-	-	-	-	2 ¹	130 00
Greenwich, . . .	-	-	18	-	-	-	-	-	-	-	-	-	60 45
Groveland, . . .	-	6	12	-	-	-	-	-	3	12	-	-	51 05
Hadley, . . .	-	-	15	-	-	-	-	-	-	-	-	-	75 00
Halifax, . . .	-	12	64	-	-	-	12	-	-	18	-	-	241 91
Hanson, . . .	-	6	24	-	6	-	6	-	-	5	-	1 ³	250 00
Harvard, . . .	2	7	14	-	2	3	-	-	3	12	-	1 ³	201 52
Holbrook, . . .	-	12	10	-	-	-	-	-	-	-	-	-	69 00
Hubbardston, . . .	-	-	52	-	-	-	18	-	-	4	-	-	175 75
Leverett, . . .	2	20	16	8	2	4	-	2	4	8	-	2 ¹	160 17
Lunenburg, . . .	2	12	10	-	2	3	4	-	3	5	-	1 ¹	149 28
Lynnfield, . . .	-	10	20	-	-	-	-	10	-	-	-	2 ¹	246 25
Maashpee, . . .	-	-	22	-	-	-	-	-	-	12	-	-	74 80
Mendon, . . .	-	-	15	-	-	-	-	-	-	-	-	-	90 00
Merrimac, . . .	-	-	15	-	-	-	-	-	-	-	-	-	75 00
Middleton, . . .	-	-	16	-	-	-	-	-	-	-	-	-	49 50
Millis, . . .	-	-	8	-	-	-	-	-	-	-	-	1 ³	242 00
New Braintree, . . .	-	-	25	-	-	-	-	-	-	-	-	-	18 15
New Salem, . . .	-	55	20	-	-	-	-	-	-	-	-	-	100 50
Newbury, . . .	-	-	6	-	-	-	-	-	-	-	-	-	18 15
Norfolk, . . .	-	-	18	-	-	-	-	-	-	-	-	-	99 00
North Reading, . . .	-	-	24	-	-	-	-	-	-	-	-	1 ¹	248 43
Northborough, . . .	-	-	25	-	-	-	-	-	-	-	-	-	102 27
Norwell, . . .	-	-	32	-	-	-	12	-	-	-	-	1 ¹	243 87
Oakham, . . .	-	12	24	-	1	1	2	-	3	3	-	1 ¹	190 85
Otis, . . .	-	-	10	-	-	-	-	-	-	-	-	-	60 00
Paxton, . . .	3	-	28	12	-	-	-	-	-	6	-	-	105 87
Pelham, . . .	-	-	19	-	-	-	-	1	-	-	-	-	76 62
Pembroke, . . .	-	-	31	-	-	-	60	-	-	-	-	1 ³	250 00
Petersham, . . .	2	10	22	-	-	3	4	-	3	5	-	1 ¹	202 55
Phillipston, . . .	-	6	14	-	-	-	-	-	-	-	-	-	48 65
Plainville, . . .	2	10	10	-	2	3	4	-	3	5	12	1 ¹	183 50

¹ One-horse.² Two-horse.³ Motor truck.

**INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT
ACT — *Continued.***

Town.	Axes.	Cans.	Extinguishers.	Hoes.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reim- burse- ment.
Plympton, . . .	-	-	-	-	-	-	-	12	-	-	-	-	\$20 98
Prescott, . . .	-	-	10	-	-	-	-	-	-	-	-	-	48 16
Princeton, . . .	-	32	80	-	-	-	-	-	-	-	-	-	249 20
Raynham, . . .	3	46	30	-	6	-	12	-	9	15	-	3 ¹	222 23
Rahoboth, . . .	-	10	48	-	-	-	-	-	-	-	-	1 ¹	250 00
Richmond, . . .	-	15	25	-	-	-	4	-	-	-	-	-	86 20
Rochester, . . .	-	24	60	-	-	-	-	-	-	30	-	-	205 37
Royalston, . . .	3	10	22	30	2	2	12	-	-	42	-	1 ¹	145 10
Russell, . . .	-	7	39	-	-	-	-	-	-	-	-	1 ¹	220 25
Rutland, . . .	-	12	18	-	-	-	6	-	-	-	-	1 ¹	250 00
Salisbury, . . .	3	-	9	-	6	-	24	-	-	6	-	-	36 87
Sandwich, . . .	22	12	36	-	-	2	-	-	-	24	-	1 ¹	245 60
Shelburne, . . .	-	-	50	-	-	-	-	-	12	6	-	1 ¹	186 87
Shirley, . . .	-	48	36	-	-	-	-	-	-	-	-	-	139 50
Shutesbury, . . .	-	16	25	-	-	-	-	-	-	-	-	-	87 50
Southwick, . . .	-	12	20	-	-	-	-	-	-	-	-	1 ¹	82 00
Sterling, . . .	-	-	25	-	-	-	-	-	-	-	18	1 ¹	241 12
Stow, . . .	-	-	42	-	-	-	-	-	-	18	-	-	131 31
Sturbridge, . . .	-	11	35	-	-	-	-	-	-	-	-	-	116 45
Sudbury, . . .	-	-	40	-	-	-	-	-	-	-	-	-	250 00
Sutton, . . .	-	50	50	24	-	-	-	-	32	24	-	-	188 46
Tewksbury, . . .	2	-	24	-	2	-	-	-	-	30	-	1 ¹	174 00
Townsend, . . .	-	-	46	-	-	-	-	-	-	-	-	-	250 00
Tyngsborough, . . .	-	120	20	-	-	-	-	30	12	24	-	-	189 80
Tyringham, . . .	2	10	10	-	2	1	10	-	2	3	-	1 ¹	112 30
Upton, . . .	-	-	30	-	-	-	-	-	-	-	12	1 ¹	235 28
Wales, . . .	2	10	40	-	2	2	-	-	-	-	-	1 ¹	236 77
Warwick, . . .	-	6	10	-	-	-	-	-	-	-	-	1 ¹	154 35
Washington, . . .	-	-	4	-	-	-	-	-	-	-	-	-	20 00
Wendell, . . .	-	-	8	-	-	-	-	-	-	12	-	-	35 07
West Boylston, . . .	-	-	107	-	-	-	-	-	-	-	-	-	250 00
West Bridgewater, . . .	-	-	20	-	-	-	-	-	-	-	-	1 ¹	200 12
West Brookfield, . . .	-	12	37	-	-	-	-	-	-	-	-	-	121 75

¹ One-horse.² Two-horse.³ Motor truck.

**INVENTORY OF EQUIPMENT PURCHASED UNDER THE REIMBURSEMENT
ACT — *Concluded.***

TOWN.	Area.	Cans.	Extinguishers.	Hoes.	Lanterns.	Mattocks.	Pails.	Pumps.	Rakes.	Shovels.	Wire Brooms.	Wagons.	Reim- burse- ment.
Westhampton, . . .	-	-	16	-	-	-	-	-	-	-	-	-	\$48 00
Westminster, . . .	-	52	48	24	-	-	24	-	-	24	-	-	242 22
West Newbury, . . .	-	10	6	-	-	-	-	-	-	-	-	-	33 75
Wilbraham, . . .	-	27	32	-	-	-	23	-	12	6	-	-	118 38
Wilmington, . . .	-	12	40	-	1	-	-	18	-	34	-	-	187 39
Windsor, . . .	-	-	30	-	-	-	-	-	-	-	-	-	150 00
Worthington, . . .	2	15	10	-	-	3	-	-	-	5	-	1 ¹	86 01
Wrentham, . . .	-	12	12	-	4	-	-	-	-	-	-	1 ¹	210 10
Totals, . . .	69	1,001	2,711	128	50	33	355	82	122	619	72	45	\$14,884 61

¹ One-horse.

TOWNS RECEIVING FIRE-EQUIPMENT REIMBURSEMENT DURING YEAR 1913.

Ashburnham,	\$25 00	Paxton,	\$105 87
Ashfield,	99 00	Pembroke,	46 25
Ashland,	34 04	Plainville,	5 00
Auburn,	39 00	Plympton,	20 93
Becket,	28 25	Richmond,	30 00
Belchertown,	100 00	Rochester,	205 37
Bellingham,	45 95	Royalston,	24 50
Boxborough,	90 46	Russell,	220 25
Burlington,	100 00	Salisbury,	38 87
Carlisle,	54 00	Shelburne,	182 50
Chesterfield,	75 00	Southwick,	82 00
Dana,	18 75	Sterling,	9 37
Douglas,	175 00	Townsend,	250 00
Dunstable,	106 14	Tyringham,	112 30
East Longmeadow,	149 71	Upton,	106 75
Freetown,	94 86	Warwick,	154 35
Georgetown,	36 00	Washington,	20 00
Goshen,	121 73	West Boylston,	250 00
Granby,	39 00	West Brookfield,	121 75
Granville,	130 00	Westhampton,	48 00
Halifax,	36 00	Worthington,	86 01
Hubbardston,	175 75		
Leverett,	160 17	Total,	\$5,012 48
Lynnfield,	160 00	Unexpended balance,	5 45
Mashpee,	40 25		
Mendon,	90 00		\$5,017 93
Millis,	242 00		
New Salem,	100 50	Appropriation,	\$5,000 00
Norfolk,	99 00	Credit by town of Wilbraham,	17 93
North Reading,	114 00		
Oakham,	52 85		\$5,017 93
Otis,	60 00		

COMPARATIVE DAMAGES BY FOREST FIRES FOR THE PAST FIVE YEARS.

YEAR.	Number of Fires.	Acreage burned.	Cost to extinguish.	Damage.	Average Acreage per Fire.	Average Damage per Fire.
1909,	1,496	35,063	—	\$189,482	23.45	\$126.66
1910,	1,385	42,221	\$23,475	205,383	30.46	148.29
1911,	2,536	99,693	47,093	537,749	39.31	226.24
1912,	1,851	22,072	20,219	80,834	11.92	43.67
1913,	2,688	53,826	35,456	178,357	20.02	66.35

FOREST FIRES OF 1913.

MONTHS.	Acres.	Damage.	Cost to extinguish.	Number.
December, 1912.	731	\$281	\$354	93
January, 1913.	43	15	44	21
February,	62	57	118	38
March,	1,351	2,896	1,133	317
April,	8,385	14,525	5,686	580
May,	21,325	93,345	9,878	684
June,	5,092	25,894	2,835	255
July,	14,113	35,050	9,915	345
August,	2,025	5,586	4,684	250
September,	388	390	501	38
October,	83	34	84	9
November,	228	284	224	58
	53,826	\$178,357	35,456	2,688

COMPARATIVE CAUSES OF FOREST FIRES FOR THE PAST THREE YEARS.

CAUSES.	1911.		1912.		1913.	
	Num-ber.	Per Cent.	Num-ber.	Per Cent.	Num-ber.	Per Cent.
Unknown,	1,123	44.5	649	35.1	650	24.2
Railroad,	685	27.0	640	34.6	913	34.0
Burning brush,	135	5.3	93	5.0	148	5.5
Smokers, hunters, berry pickers,	158	6.2	223	12.0	386	14.3
Steam sawmills,	3	.1	8	.4	6	.2
Children,	118	4.7	79	4.3	109	4.1
Miscellaneous,	309	12.2	159	8.6	476	17.7
Totals,	2,536	100.0	1,851	100.0	2,688	100.0

**PRECIPITATION IN INCHES FOR THE YEARS 1911, 1912 AND 1913, WITH
DECEMBER OF PREVIOUS YEAR.**

MONTHS.	1911.	1912.	1913.	Normal.
December,	3.24	2.59	5.73	3.74
January,	3.07	3.87	3.21	4.12
February,	3.20	2.24	3.77	3.97
March,	3.27	5.26	5.32	4.34
April,	2.86	4.05	4.73	3.46
May, . . . . .	.89	4.03	2.85	3.37
June,	4.76	.53	3.20	3.07
July,	4.55	4.16	2.00	3.65
August,	6.70	3.85	3.20	3.70
September,	3.36	1.71	2.77	4.36
October,	3.01	1.52	7.62	4.13
November,	5.71	3.45	2.70	3.96
Totals,	44.62	37.26	47.20	45.87

In addition to our town forest wardens we have 1,740 deputy wardens, 1,205 of whom have telephone connection with our observation towers. We desire to have at least 6 deputies in each town located in different places throughout the forest area.

The permit law, which has been in operation for the past three years, has given general satisfaction. There are still a few towns that have not accepted the act which we hope will take advantage of it at their next town meeting. Nearly 17,000 permits have been issued, with no serious fires resulting from them. The comparative table on page 73 shows acreage burned, cost to extinguish and damage caused. While this table shows an increase in damage, it also shows that we have had 837 more fires than last year and 156 more than in 1911, when our loss was \$537,749.

Early in the season 12,000 cloth and cardboard notices, calling attention to the fire losses in previous years and quoting extracts from the forest-fire law, were posted conspicuously in every town in the State. In spite of this we have had 19 prosecutions, 14 of which resulted in convictions for violations of the forest law.

Exceptionally good results have been accomplished by our observation stations this year. With a drouth lasting nearly eight weeks throughout eastern Massachusetts, including the dry and sandy Cape country, and with a record of over 3,000 fires reported by the observers, our records show only 6 serious fires which were allowed to burn some days without extinguishment. A careful investigation of these 6 fires has revealed in each case the presence of one or more of three common causes, namely, inefficiency in the town forest fire organization, lack of proper forest fire

fighting equipment, and indifference on the part of the general public until such time as the fire assumed sufficient proportions to threaten their villages and homes. I do not wish to give the impression that this is the state of affairs in every town, but I must admit that it has been found to be the condition in several instances where serious fires have occurred, and until these conditions can be remedied, or this department vested with authority, equipment and funds so that we may be in a position to assume full responsibility, just so long shall we have serious fires and unnecessary damages. It is of the greatest importance that some system be adopted whereby this department can be of assistance to the various towns in handling their more dangerous fires. We should be supplied with at least two motor trucks equipped with modern forest fire apparatus and capable of carrying from 10 to 15 men trained in forest-fire work. These trucks should be placed under the supervision of the district forest wardens and located, one in the Cape country and one in the central part of the State. Nearly every serious fire has been practically extinguished the first day, but for various reasons was allowed to start anew the second day and was beyond control before night. It is on such occasions as these that we need men trained in this line of work with sufficient equipment to handle large fires, together with some method of quick transportation to enable them to get to the fire promptly. With automobile trucks located as above we would be able to reach any fire throughout the eastern part of the State within two or three hours.

Respectfully submitted,

M. C. HUTCHINS,
State Fire Warden.

GYPSEY AND BROWN-TAIL MOTH WORK.

The conditions of this work were discussed quite fully in last year's report by the writer. One year's time has not very materially changed them, generally speaking; nevertheless, I am frank to say that this work has never been more thoroughly comprehensive and better prosecuted than at the present time. Our organization is smaller, the men are giving greater study to the problems and more real work of a permanent nature is being done. The State Forester has constantly endeavored to impress the importance of making the moth work practical and self-supporting wherever and whenever possible. The local moth superintendents in our cities and towns are yearly acquitting themselves as men in whom confidence and public trust may be placed. When this work was first placed under my charge the constant yearly changes in the personnel of the local superintendents, due to various causes, resulted in much

of the adverse criticism so common at that time. It has not been a pleasant duty to be compelled to differ with town authorities now and then, but it is fair to say that these differences are in these later days amicably adjusted, as there is a better and more wholesome understanding of the aims and purposes of the work.

It was due to the confidence in and ability of the local moth superintendents in our various cities and towns that it was possible to dispense with the office of inspector in this department during the present year. A few years ago it was necessary to have a force of 54 men in the general supervision of the moth work; this same work is now carried on by 15 men. Better equipment and modern transportation facilities, together with experienced superintendents already alluded to, have made this possible.

Fifty more high-power sprayers were purchased by cities, towns and private parties last spring. These, together with the equipment already on hand, have increased our efficiency very much. As has been emphasized heretofore it is necessary to have tools to work with to get work done. Occasionally a town finds it easier to contract its work out rather than go to the expense of equipment of its own, but invariably it pays out more and gets less done. A local superintendent who has a power sprayer feels it incumbent upon him to properly care for the public trees, while invariably citizens apply to him to have their private estates sprayed. This private work pays for itself and indirectly is of equal benefit to the town or city, besides giving employment to labor for a longer period, which guarantees a better quality.

It is estimated that fully 500 tons of arsenate of lead were used during the season.

At stripping time each of the division men made a careful survey of the forest lands thus infested, and submitted a list to the office, — the number of acres stripped, their location, together with the owner's address. Later printed notices were sent to each of the property holders offering advice. This information has resulted in splendid co-operation, and much practical work is now under way.

The division men are endeavoring to get some real object-

lessons established in their respective territories which, once accomplished, will serve an excellent purpose by way of instruction.

The parasites and the two diseases used in suppression work are certainly pleasing factors and give great encouragement. (See Dr. L. O. Howard's report on parasites and their work which is printed elsewhere.) The diseases are thoroughly established and are extremely effective.

The United States government is concentrating its energies on holding the spread, and therefore this perplexing problem is in good hands. A belt across the State, three towns' wide, has been taken over by them, and every precaution is being exercised to hold the ground from further advance. This department is increasing its work in the towns next to those the government is caring for. Most of these towns have relatively low valuations and are largely wooded, and hence are unable to cope with the situation alone. Our strategic points now are to maintain our present ground and, through better methods and the assistance of diseases, parasites and forestry practices, eventually to hold them under subjection. It is no time, however, for us to lessen our earnestness. The government, State and town forces are all working harmoniously together, and it is believed each year will show improved conditions.

PRIVATE PROPERTY WORK AND THE MOTH SUPERINTENDENT.

The effective work accomplished by local moth superintendents last year on private property which is self-supporting has continued in increasing interest and public approval. The ideal town is one with a hustling, broad-minded moth superintendent, who is given full charge of the care of the trees and in whom everybody has confidence. Such an official should be employed by the year and his whole time given to the work. If the office of tree warden were an appointive one, the combination of the two positions would be ideal; here is one of our present difficulties, but in time this problem will settle itself. The position of city forester solves the question for the cities.

The moth superintendent, through the opportunities offered on private property, can plan his work accordingly and enlarge his usefulness to the town. The more private work there is

the greater the opportunity to employ labor and hence to secure an active force of permanent men.

It does not follow that just because the moth work is fixed by law, a man selected to take charge of it cannot engage in other equally beneficial undertakings to improve and care for the trees and shrubs of his town. There is no reason why a superintendent should not do other work on private property, such as pruning and spraying for other insects, provided the work is self-supporting. The amount of private work is yearly increasing in our towns and cities, and this is indicative of better results generally and an activity that savors of better conditions in the future.

THE TENT CATERPILLAR.

One of our native insect pests which is the cause of great annoyance and damage to the farmers of Massachusetts is the common apple tree tent caterpillar.

Nearly every year it is found in more or less abundance in various sections of the State, and the past two seasons have witnessed serious outbreaks of the insect. Its favorite food is the wild cherry, which is found growing along roadsides and stone walls which serve as breeding places for it. The tent caterpillar is easily recognized, owing to its habit of building a conspicuous nest in the fork of a limb which provides a shelter for it during stormy weather.

From these tent-like homes the caterpillars immerse during pleasant days and feed on the foliage of the tree. The adult of this insect is a reddish-brown moth with light-gray markings. It is flying about from the middle to the latter part of the summer, and the female moth deposits her eggs in a compact, dark-colored mass, usually entirely encircling a twig of the tree. In this stage of its life-history it remains during the winter, the eggs hatching the following spring. As soon as hatched the little hairy caterpillars begin feeding on the buds. At this time they begin the construction of the tent or nest in a near-by fork. As the foliage develops, the caterpillars feed on it, growing all the time. The caterpillar attains maturity about the 1st of July. Fully grown, the caterpillar is nearly 2 inches long. The general color of its body is black with a



A neglected orchard in the country. Orchards of this type are a menace to the surrounding country. They are non-productive and act only as breeding places for depredations of all kinds. They should be properly cared for or destroyed. This orchard not only was infested with tent caterpillar, as shown, but abounded with a mixture of insects and diseases. Mandatory legislation is the only effective remedy.



A neglected city orchard. Real estate has gone up in value and this property is being held as a waiting investment. These trees are neglected, and constitute a menace to the surrounding country. The land for house lots would be just as valuable without them, and why not give them away for the wood. Enough obnoxious insects are bred here to destroy shade, fruit and forest trees all about it. This should not be allowed.

white stripe running the entire length of its back, and on each side may be seen a row of blue spots. Soon after reaching maturity the caterpillars leave the tree, and finding suitable shelter, transform to the pupa stage. There is but one generation of this insect a year.

The tent caterpillar is not difficult to control, and may be easily suppressed by spraying the trees with arsenate of lead, using 4 or 5 pounds to 50 gallons of water. Other methods are employed to destroy the caterpillars, such as burning them with a torch when they have collected on the nest during cool or cloudy weather. Care should be exercised in the use of a burning torch, however, as the tree may be seriously injured by burning the branches.

Another insect found in Massachusetts closely related to the apple tree tent caterpillar is the forest tent caterpillar. This caterpillar may be distinguished from the ordinary tent caterpillar described above by the fact that it has a pale blue head, and instead of the white stripe which marks the other species its back shows a row of white diamond-shaped spots. Its life-history is very similar to that of the common tent caterpillar, although it does not build a nest of any kind. As its name indicates, this insect is essentially a forest pest, although it attacks both shade and orchard trees.

Fortunately, it is held in check by natural enemies in the form of parasites and diseases, but if serious outbreaks occur the insect may be controlled by spraying with arsenate of lead, as in the case of other leaf-eating insects.

BENEFITS TO COME FROM BIRDS.

The conservation of bird life is a worthy problem, and our ornithologists and naturalists generally are rightfully solicitous for their propagation and protection. Occasionally a person gets it into his mind that this department disregards bird life in our operations. Nothing could be a greater mistake. When the effect of arsenical spraying and bird life was aired in the press a few years since, the State Forester took the matter up with Mr. Forbush, the State Ornithologist, and some definite co-operative experiments were carried on in which Mr. Forbush exonerated the spraying.

During the past two years splendid interests have been manifested in preserving bird life here in Massachusetts. Already town bird wardens have been appointed in a few towns. Bird sanctuaries, feeding grounds, covers for protection, houses, etc., are all receiving attention. This department is in perfect accord with all of this work, and further observation and recognition of assisting bird life will be given more consideration the coming season than ever. An interesting paper was presented by Mr. Wm. P. Wharton, before the Massachusetts Forestry Association at the annual meeting, which pointed out some observations he made abroad during the past summer. Some experiments along the suggestions made by Mr. Wharton may be put into operation here the coming year. There is every reason to believe that much good can be accomplished through enlisting the forest wardens and the local moth superintendents more actively in this work. These men are already town officials, and will gladly assist in every way.

Another season I shall hope to go into this whole matter more in detail. It is not a question simply of the effect of bird life upon the moth problem alone that the department of the State Forester is interested in, but one which affects all forest and shade-tree pests.

WORK ON STATE HIGHWAYS.

This department assisted the State Highway Commission to the extent of looking after the spraying of the highways throughout the moth-infested section of the State. The spraying for the elm-leaf beetle was included in this work. Where we are able to use a traveling sprayer the work accomplished is satisfactory, but it is necessary to arrange with towns to do the work in many cases with varying results, since the town equipments for doing the work are widely different. With such a mileage of State roads it would seem an economical expenditure were the State prepared to do this work through the use of modern auto truck sprayers. Besides being very effective during the spraying season they could be used for planting work, removing brush, etc., at other seasons of the year.

Work was done in the following cities and towns on the State highways, and paid for by the Highway Commission:—

STATE HIGHWAY BILLS, 1913.

Acton,	\$41 25	Grafton,	\$15 75
	109 76		28 10
Amesbury,	13 59	Groton,	24 08
	15 75		15 70
Andover,	31 50	Groveland,	25 74
	48 51		22 87
Ashburnham,	39 50	Hamilton,	38 70
Ashby,	49 13		7 75
Ashland,	19 50	Haverhill,	82 71
	45 82		70 82
Attleborough,	16 50	Harvard,	22 92
	43 12		21 90
Barnstable,	10 00	Hingham,	27 60
	395 00		46 50
Barre,	19 00	Holbrook,	10 50
Bedford,	35 19	Holliston,	10 00
	32 10	Hudson,	34 87
Bellingham,	13 10		7 76
Beverly,	115 03	Ipswich,	19 50
	39 45		28 50
Billerica,	29 00	Lakeville,	3 50
	36 00		42 77
Boxborough,	59 00	Lancaster,	37 20
	63 75		14 98
Brewster,	30 00	Leominster,	7 81
Bridgewater,	31 40	Lexington,	94 50
Burlington,	126 50		16 32
	34 00		3 69
	67 70		22 95
Chelmsford,	43 13	Lincoln,	14 63
	55 30		47 00
Cohasset,	20 40	Littleton,	17 00
	13 28		57 78
Concord,	51 11	Lowell,	17 85
	46 78		23 19
	99 13	Lunenburg,	30 24
Dennis,	6 00		11 85
Dighton,	93 77	Marlborough,	144 20
Dover,	30 94		96 91
Dracut,	42 00	Marshfield,	28 50
	21 32	Melrose,	9 60
Duxbury,	16 00		22 20
Falmouth,	70 55	Merrimac,	18 96
Fitchburg,	51 95		10 69
	25 44	Methuen,	38 25
Foxborough,	8 00		48 43
	87 00	Middleborough,	29 03
Framingham,	78 25	Millbury,	6 15
	29 92		4 47
Franklin,	18 50	Milton,	1 98
	26 50	Natick,	13 22
	6 50		34 85

STATE HIGHWAY BILLS, 1913 — *Concluded.*

Needham,	\$30 65	Swansea,	\$127 75
	27 53	Taunton,	5 40
	9 96		30 39
Newbury,	51 64	Templeton,	7 50
	23 71	Tewksbury,	43 60
Newburyport,	22 95		61 58
	13 64	Townsend,	162 37
North Andover,	92 40		47 00
	56 25		64 80
North Attleborough,	64 05	Tyngsborough,	41 50
North Reading,	14 00		93 25
	23 75	Wayland,	50 75
Northborough,	101 50		47 98
	26 60	Wellfleet,	30 00
Norton,	11 00	Wenham,	56 25
	32 75		38 50
Norwood,	5 50	West Boylston,	39 38
	62 10	West Bridgewater,	9 00
Pepperell,	37 50		4 68
	27 25	West Newbury,	54 22
Quincy,	10 00		43 66
Reading,	63 00	Westborough,	21 00
	92 00		8 70
Rockland,	20 00	Westford,	56 00
	68 75		64 00
Rowley,	49 80	Westminster,	7 50
	53 32	Weston,	58 50
Salisbury,	43 19		44 50
	41 65	Westwood,	16 50
Sandwich,	21 00	Weymouth,	30 00
Scituate,	55 20		95 81
	79 70	Wilmington,	24 95
Shrewsbury,	26 10		50 17
Somerset,	110 37	Winchester,	50 80
Southborough,	29 75		48 15
	29 40	Woburn,	27 00
Sterling,	65 08		61 50
	22 00		13 19
Stoneham,	33 70		91 98
	82 74	Worcester,	15 68
Sudbury,	162 40		\$7,930 06
	92 80	Credit by balance,	369 94
Sutton,	8 00	Total appropriation,	\$8,300 00
Swampscott,	5 00		

PARASITE WORK.

REPORT OF DR. L. O. HOWARD, CHIEF OF THE BUREAU OF ENTOMOLOGY,
WASHINGTON, D. C.

UNITED STATES DEPARTMENT OF AGRICULTURE,
BUREAU OF ENTOMOLOGY, WASHINGTON, D. C., Dec. 20, 1913.

Prof. F. W. RANE, *State Forester, Boston, Mass.*

DEAR PROFESSOR RANE:— In accordance with your request, I take pleasure in submitting a brief report upon what has happened to the imported parasites of the gypsy moth and the brown-tail moth during the year.

Yours very truly,

L. O. HOWARD,
Chief of Bureau.

The work on parasites and predatory enemies of the gypsy moth and brown-tail moth has continued along the same lines as during the previous year, except that no attempt has been made to import additional parasites this season. The material imported from Europe last year has been colonized, and an effort has been made to determine the extent to which the species secured have established themselves in the field.

Owing to the fact that one of the imported egg-parasites of the gypsy moth, *Anastatus bifasciatus*, breeds very slowly, extensive collections were made during the last winter of parasitized gypsy moth egg-clusters from colonies that were planted in previous years. From this material it has been possible to liberate 1,500,000 parasites of this species, and these have been placed in 1,500 colonies in sections where the insect had not become established. Eight hundred colonies were planted in towns along the western border of infestation, and the balance was liberated in a number of towns in the northern part of Massachusetts. During November of this year collections were made in New Hampshire, in the colonies of *Anastatus* that were planted a year ago, and examination showed that these plantings were practically all successful, although the spread has been slow. From these collections about 100,000 parasitized eggs were secured and will be used for colonization in New Hampshire next spring.

Investigations have shown that another egg-parasite of the gypsy moth, namely *Schedius kuvanae*, has become perfectly established in several colonies where it had previously been planted. During the past year there has been a decided increase in the abundance of this parasite, and in some cases it has spread nearly a mile and a half from the limits of its last year's spread.

The parasites attacking the caterpillars of the gypsy moth have been found more abundantly than during the previous year. *Compsilura*

concinata, a species of Tachinid fly, was very abundant during the summer of 1912, especially in the territory which was longest infested by the gypsy moth, and continued to spread during the past summer. It has not been so abundant in the oldest infested territories as in some of the outlying colonies. Collections of more than 1,100 gypsy moth caterpillars made in 4 towns in central Massachusetts show a parasitism by this species of over 40 per cent., while similar collections in the central infested area have indicated an average parasitism of about 5 per cent. It is probable that the decrease in parasitism in the old infested area, as far as this species is concerned, is due to the fact that gypsy moth caterpillars are not nearly as abundant as they were during the previous year, and also because of the enormous numbers of the American tent and forest tent caterpillars which were present in this region and which are also attacked by this parasite.

Limnerium disparidis and *Apanteles* species were received from Europe for the first time in 1911, and were planted in several badly infested gypsy moth colonies. Both species were recovered during the summer of 1912, which indicated that it is possible for the insects to withstand our cold winters. In the case of the latter species, as high as 7 per cent. of parasitism of gypsy moth larvæ was found. The present summer the *Limnerium* was recovered from a single locality where the species was liberated in 1911. Although it has evidently become established, it has not thus far shown marked ability to increase in the gypsy moth infested area in New England.

Another species of *Apanteles*, namely, *A. lacticolor*, an important parasite of the brown-tail moth caterpillars, has been recovered in large numbers, and has been found to attack gypsy moth caterpillars in widely separated regions. This species seems to be multiplying more rapidly than any of the other Hymenopterous parasites of the gypsy moth. In order to colonize this species over as wide an area as possible, an arrangement was made with the State Entomologist in New Hampshire, and the superintendent of moth work in Maine, to liberate as many colonies as possible along the outskirts of the area infested by the brown-tail moth in those States. Small collections of gypsy moth larvæ were made at Melrose, and in some cases 10 per cent. of the larvæ were killed by this species. In several localities in New Hampshire the past summer the cocoons of this parasite were very abundant, and several hundred were easily collected for experimental work. They were taken, for the most part, on the foliage of trees, and attached to dead caterpillars.

The *Calosoma* beetle (*Calosoma sycophanta*) has been observed in large numbers in towns where bad colonies of the gypsy moth were present. It has not been possible to obtain definite records of the amount of benefit derived from this species, or of its abundance, except in cases where trees were burlapped, as these bands furnish favorable hiding places for the caterpillars and are favorite locations for the beetles and larvæ to obtain food. In such cases, where caterpillars were abundant, 20 or more of

the *Calosoma* larvæ have frequently been found under a single burlap band on an average-sized tree. As they feed upon the pupæ as well as upon the caterpillars, the amount of benefit derived is very great, although it is difficult to figure the percentage of larvæ killed.

From collections made during the winter of 1912-13 it was determined that *Monodontomerus aereus* has spread over practically the entire territory now known to be infested by the brown-tail moth. It was not found in as large numbers as during the previous year. *Pteromalus egregius* has been found widely scattered over the area infested by the brown-tail moth, and its numbers are slowly increasing, judging from the records that have been secured from sample collections.

There is thus no doubt that a number of the imported species are thoroughly established, and that they are increasing each year, and, further, that many hundreds of thousands of caterpillars were killed by them during the past summer.

THE WILT DISEASE OR "FLACHERIE."

The experimental work with this disease has been carried on almost wholly during the past season under the direction of Dr. W. M. Wheeler of the Bussey Institution of Harvard University and Dr. L. O. Howard, division of entomology, United States Department of Agriculture. The results of this work will be reported on later. The disease itself is found spread generally throughout the moth-infested territory, and is proving a great factor in the control of the gypsy moth. It is to be hoped that through the studies by experts discoveries may be made whereby this disease can be even further made use of in the work of suppression.

THE FUNGUS DISEASE OF THE BROWN-TAIL MOTH.

The work of propagating and disseminating this disease was undertaken and carried out under the usual co-operation with Harvard University. The work of the previous season having been so successful it was thought we could not help getting results from our ripened experience. We had plenty of caterpillars to work with, but, unfortunately, try as we might, the spores could not be secured to produce the results wanted. The cool season, we believe, had most to do with it. Later on in the year, however, a number of places were found where the wilt disease occurred in nature and was extremely effective. We are not discouraged, however, and hope to regain our

ground in producing the disease on a large scale for general distribution the coming spring. One thing is perfectly sure and that is, this disease is extremely effective in destroying the brown-tail moth larvæ.

NORTH SHORE WORK.

The usual co-operative work on the North Shore between the summer residents committees, the towns and the State Forester's department, has been carried on again the past season.

If those who are in touch with this work should be consulted, it is believed that the universal verdict would be that the season has been a most successful one. Through his continued splendid co-operation, this department feels especially indebted to Col. Wm. D. Sohier for making it possible to demonstrate what can be accomplished under favorable environment. The North Shore work is beginning to radiate its effect elsewhere.

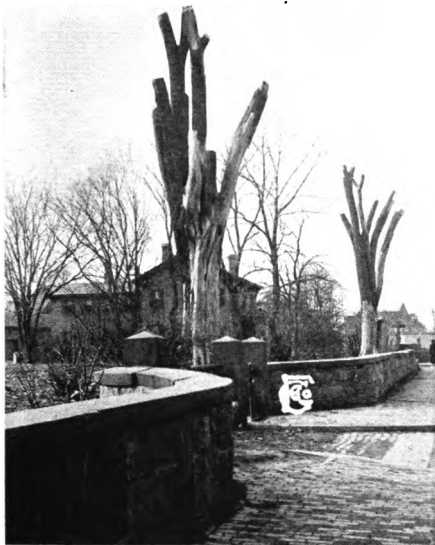
The following is a reproduction of the financial statement of the summer residents committees' report that relates to the moth and forestry work:—

DETAILS OF THE COST OF THE WORK FROM JULY TO JULY.

Spraying 3,610 acres,	\$19,973 43
Cutting and burning 407 acres,	6,919 33
Creosoting 2,871 acres,	4,040 57
Tanglefooting,	35 57
Leopard moth work,	192 11
Spraying for aphids,	20 21
Road repairing, 7,925 square feet,	92 80
Tool repairing,	851 69
Repairs on shop,	343 00
Repairs on engines,	1,019 07
Experimental work,	12 00
	<hr/>
	\$33,499 78

AVERAGE COST OF WORK.

Spraying per acre,	\$5 53
Cutting and burning per acre,	17 00
Creosoting per acre,	1 41



A view of some of the old trunks of elms which have died from neglect in spraying. From a business standpoint these trees could have been sprayed yearly for the interest upon the cost of removing them. Estates losing large trees like these also invariably greatly depreciate in value. It is, therefore, good business for municipalities and individuals to spray and care for their trees.



A deciduous forest at Concord entirely defoliated by the forest tent caterpillar. This photograph was taken by the State Forester on July 3. This insect, it is predicted, will be very destructive the coming spring. Spraying with arsenate of lead, as for moths, will control it.

LECTURES AND ADDRESSES.

The State Forester has been called upon for a large number of engagements throughout the year. As much of this work has been done as time would permit. Mr. C. O. Bailey and Mr. H. O. Cook have assisted in this work. Mr. R. G. Pierce, the expert on the chestnut bark disease, has in addition to those listed made quite a campaign throughout the State where the chestnut is indigenous.

Now that the Massachusetts Agricultural College has a department of forestry, the lectures heretofore given by the State Forester have not been necessary, and the past season the lectures were confined to the subject of State forest policy.

The following organizations were addressed during the year: —

Brewster Village Improvement Society.
Essex County Pomona Grange.
Russell State Grange Field Meeting.
Middlefield Highland Agricultural Society.
Acton State Grange Field Meeting.
Concord Men's Club.
Cohasset Men's Club.
Stoughton Board of Trade.
Wareham Men's Club.
Hale Club, Boston.
Fitchburg Forestry Association.
Paxton Grange.
West Brookfield Field Meeting, State Grange.
Fall River Chamber of Commerce.
Watertown Men's Club.
Bristol County Fair.
Holden Farmers' and Mechanics' Association.
University of Syracuse, Syracuse, N. Y.
Men's Club, Newton Center.
Paper Makers' Association, Boston.
Town of Dover, Town Hall.
Quinebog Historical Society, Southbridge.
Hyde Park Village Improvement Association.
Borough Pomona Grange, Berlin.
New Bedford Forestry Association.
New Bedford High School.
Pomona Grange at Medfield.
Massachusetts Agricultural College.
Association of Tree Wardens and Foresters, Amherst.
Rural Club.

Amesbury Village Improvement Association.
Wellesley Village Improvement Association.
East Freetown Grange.
Men's Club of Congregational Church, Arlington.
Milton Woman's Club.
Bridgeport Club, Conn.
Smith College.
East Bridgewater Men's Club.
Public Meeting, town of Hubbardston.
Springfield Forestry Association.
Leominster Forestry Association
Twentieth Century Club.
Jamaica Plain Men's Club.
Business Men's Association and Natural History Club, Plymouth.
State Grange Field Day, Colrain.
Royalston Improvement Association.
State Grange Field Day, Springfield.
State Grange Field Day, Orange.
Massachusetts Tree Wardens' and Foresters' Association, Boston.
Massachusetts State Firemen's Association.
Nantucket Civic League.
Fire Prevention Association, Philadelphia.
Public meeting, City Hall, Dedham.
Society for the Promotion of Agricultural Science.
Massachusetts State Grange.
Hyannis Woman's Club.
State Normal School, Hyannis.
Avon Club, Winchendon.

FIELD MEETINGS OF THE STATE GRANGE.

The field meetings of the State Grange that have been held during the summer months for the past two years in various parts of the State have been exceptionally interesting, and without doubt have served to stimulate the interest of our farmers in all the movements that have been inaugurated in the interest of rural progress.

While the discussions at these meetings covered many fields of public endeavor, it was gratifying to note the deep interest that was manifested in the talks given on forestry by State Forester F. W. Rane and Sec. C. O. Bailey, who were speakers at several of these meetings.

The Society for the Promotion of Agricultural Science convened at Washington, D. C., November 11, and the Massachusetts State Forester delivered the following paper before said society:—

WHAT MASSACHUSETTS HAS ACCOMPLISHED FOR SCIENCE IN HER FIGHT AGAINST THE GYPSY AND BROWN-TAIL MOTHS.

The pages of universal history may be scanned in vain for a record of a war between nations which has not resulted in new inventions or discoveries that have served to advance civilization, — discoveries that were made possible by the exigencies of the times. This progressive knowledge has become the bulwark of the development and stability of the nations of the earth. In her war against the gypsy and brown-tail moths, the experience of Massachusetts has not been at variance with past history.

Throughout the long and costly struggle to save our forest and shade trees from being completely destroyed by these voracious insects, inventive minds, as in other wars, have been studiously engaged in developing better and more destructive methods of warfare, from which a permanent addition to science has resulted.

The Commonwealth of Massachusetts has placed all science in its debt by the interesting and successful experiments which it has carried on in the importing and breeding of parasites and other natural enemies which prey on the gypsy moth and the brown-tail moth. This work was inaugurated on a large scale in co-operation with the United States Department of Entomology in 1905, shortly after the Commonwealth had for the second time undertaken to suppress these two insects. The work has been attended with a large measure of success, and during its prosecution various interesting scientific discoveries have been made in regard to these insects and their life-history, and also in regard to the life-history of their various parasites and related insects.

The importation of the Calosoma beetle (*Calosoma sycophanta*) from Europe to destroy the gypsy moth has resulted in much practical and interesting data in regard to the beetle and its habits. It is a pronounced success.

The construction and equipment of the laboratory where the work has been carried on has attracted the attention of the scientists all over the world, and in the year 1907 several eminent scientists from this country, Europe, Africa and Australia visited the parasitic laboratory, which was then at Saugus, Mass. None of these men could suggest improvements in the methods used, but they all found many to admire and some to copy in their own countries where similar lines of investigation were being inaugurated.

Much experimenting has been carried on, also, with the fungous disease of the brown-tail moth and with the so-called wilt disease, or "flacherie," which attacks and destroys the gypsy moth to a large extent.

The development of spraying machines and insecticides makes one of the most striking and important chapters in the history of the moth-suppression campaign. The necessity for an insecticide possessing superior adhesive qualities, at the same time containing sufficient poisonous properties to destroy the caterpillars, was early recognized. Spraying with common arsenical poisons, such as Paris green, London purple, etc., had been in use for many years; but with indifferent success. When it became evident that these insecticides were not accomplishing the work desired, an effort was made to discover a more effective poison, and much time and labor were spent in this undertaking. Some of the best chemists obtainable were employed by the State and put on this experimental work, which resulted in the production of arsenate of lead.

This work was carried on in the year 1893. Since then the use of this material has increased by leaps and bounds, until at the present time the manufacturers of this article are shipping it to all parts of the world. Thus to Massachusetts moth work the agricultural world owes an everlasting debt of gratitude for her persistent and successful endeavors along this line. The results of the untiring efforts of the Massachusetts Forestry Department in developing improved spraying machines, hose couplings, nozzles and other apparatus of this nature have completely revolutionized this industry, and present a record of accomplishment in this line never before equaled.

By improved machinery in spraying we are now able to spray woodlands at about \$6 an acre, while formerly the expense was \$40 or more. The work, as well, is far more thoroughly done. While this improved spraying machinery is highly appreciated in the moth-infested country of New England at present, it will take time for others to recognize its merits, until the use of similar machines is demanded elsewhere. When the elm-leaf beetle and similar insects and diseases begin affecting tall trees elsewhere, which is inevitable in the future, then I am confident the results of our Massachusetts inventions will be appreciated. Already

the cities of Washington, Baltimore and Albany are using these high-power tree sprayers and others are bound to follow.

By being able to throw a stream over the tallest of our shade trees from the ground, and hence eliminating the cost of climbing, not only is the great expense of labor overcome, but a whole street can be sprayed during the same length of time formerly required for the treatment of but a few trees. Our latest device is to substitute auto trucks for horses in our highway, shade-tree, park and city work which is proving very satisfactory. The same power that drives the auto also does the spraying.

With our present spraying equipment of all kinds in Massachusetts alone, I believe we use in a single season nearly 1,000 tons of arsenate of lead. The State Forester's contract for lead the past year was 500 tons.

One would hardly expect that such a pest as the gypsy moth would be an aid to the introduction of forestry methods in the treatment of our woodlands. Rather, one would expect it to be the reverse, but such is not the case.

When the office for the suppression of the gypsy moth and that of the State Forester were united in 1908, the writer strongly advocated that forest thinnings and improvement cuttings would be of great assistance in combating the depredations of this pest. He argued that not only would the woodlands be in a better physiological condition for having the weakened and suppressed trees removed, and hence better able to stand the stripping of the caterpillars, but in addition the operations of hand suppression and spraying could be more cheaply performed because the superfluous trees would be taken out. Such cuttings thereafter as were made directly by the department were supervised by trained foresters, and at the same time he urged municipalities and private owners to do as much of this work as possible and to make use of his assistants.

Within the past year or two scientific facts have come to light which vastly add to the importance of modern forestry practice as a control to the gypsy moth. Mr. Burgess, an entomologist of the United States Bureau of Entomology, who was doing co-operative work with the Massachusetts State Forester, in studying the feeding habits of the gypsy moth in the laboratory and the field, found that this insect is by no means the omnivorous feeder that it is commonly supposed to be; that although it does eat the leaves of a large variety of trees, it actually thrives best on only a few, and that if deprived of this favorite food entirely, soon succumbs to parasitic enemies.

These experiments of Mr. Burgess were supplemented by some observations of Mr. Fiske, another co-operating government entomologist, made in Europe. Mr. Fiske returned to this country last year convinced that the *chief* reason for the comparative harmlessness of this insect in that continent is due to the better silvicultural condition of the European forests. This silvicultural condition has been brought about by centuries of forestry practice. In addition, as already observed in Massachusetts with white pine, its freedom from the pest in clear stands proved also

true of all coniferous growth abroad, especially in Germany, because the conifers are all highly resistant trees. The writer, after a study of these conditions in Europe in the summer of 1912, returned with even greater conviction that forestry management can be made a great factor in moth control. Under proper conditions we too should have a much larger percentage of coniferous growth, but unscientific lumbering and forest fires have conspired to reduce it to a minimum.

* These discoveries have molded beautifully into the Massachusetts State Forester's methods of management, and offer a wide field for forestry development. Our woodlands should be thinned and the favorable trees, notably the oaks and birches, removed. Where there is little chance of resistant species taking the place of those cut out, artificial reforestation must be resorted to. Such operations must in time result in the removal of a large share of our scrubby oak woodlands and their replacement by fine plantations of conifers; clear stands of resistant deciduous species are also practical undertakings. So important has this subject appeared to the United States Bureau of Entomology that they have induced the United States Forest Service, during the past year, to co-operate in experiments to test the value of forestry work in moth suppression. The Massachusetts State Forester has increased his staff by the addition of two professional foresters to the moth division of his department, and they are carrying on a regular campaign urging woodland owners in moth-infested sections to put their lands under proper forestry management. Several gangs are now at work under direction, making improvement cuttings.

If forestry work is an aid in the control of the moth, conversely the gypsy moth is of assistance in the development of forestry practice, although at first sight it would seem to be a death-blow to this development. I can safely say that as a result of our moth depredations thousands of acres of our woodlands are being put under scientific management which otherwise would never have had such care for some time to come.

In conclusion, therefore, while the expenditure of vast sums of money has been necessary to combat the moth ravages in one of the most noted insect warfares ever undertaken by a single State, nevertheless, such an expenditure has been fully warranted by the results; and to Massachusetts must be attributed the courage of attempting and prosecuting a work recognized the world over as a most plausible and worthy undertaking. The many beneficial accomplishments which have been the outgrowth of this work have contributed largely to the enrichment of both science and industry, thus making Massachusetts again a world benefactor.

The following is an abstract of an address delivered by State Forester F. W. Rane before the Convention of the Massachusetts State Firemen's Association at New Bedford, Sept. 24, 1913: —

IMPORTANCE OF CONTROLLING FOREST FIRES IN MASSACHUSETTS.

MR. PRESIDENT AND GENTLEMEN OF THE STATE FIREMEN'S ASSOCIATION:
— I first desire to give you the assurance of my grateful appreciation of the invitation which enables me to be present at this time, privileged to participate in the deliberations of your association.

I believe that it is fast becoming an acknowledged fact that no question is of greater importance in its relation to the future prosperity of our Commonwealth than the development of forestry. The development of forestry in Massachusetts is an effort to apply a policy of foresight in handling what may be termed one of our greatest natural resources. In other words, it is a part of the great conservation movement, the importance of which is acknowledged by all thinking people.

But, gentlemen, forestry, like all other great undertakings, has to encounter obstacles and overcome them before the fullest measure of success can be attained.

In speaking to your organization at this time I shall endeavor to confine my remarks to that branch of the forestry service which, in my opinion, most directly appeals to you, namely, forest fires.

Fires injure forestry and forests in this State in several ways, which may be classified under two general divisions,—direct and indirect damage.

We all recognize the injury when commercial woodlands are burned over and the trees are killed outright, or are so injured that they will die in time. In the more thickly settled portions of our Commonwealth our woodland has a worth in excess of its value as timber or cord wood,—an æsthetic value, so to speak,—and in such cases fires cause a damage which cannot be reduced to terms of money. In any case, it is difficult to express the damage caused by fires in terms of money, but in those comparatively few cases in which it can be done, the average yearly loss is more than \$200,000, and I feel safe in saying that this sum represents only a fraction of the real danger.

A direct injury, which is caused by fire and which is not considered by the ordinary layman, is the destruction of young growth. From this young growth our future forests must come, and if these immature stands are destroyed, future values are wiped out at the same time. If a plantation of young trees which has been artificially set out is destroyed, we are quick to recognize the loss, but a reproduction which has come up naturally is just as valuable, provided it gives indications of making a stand of trees as large and as salable as the artificial plantation. Young stands are not to be judged by their present condition, but by their future possibilities.

Constant fires exhaust the soil, consuming as they do the humus or dead-leaf matter which is the material from which nature manufactures our loamy soils. By the destruction of this same humus the waste-storage possibilities of the soil are taken away and drought and floods become more frequent.

These direct injuries, as great as they are, I believe are exceeded by the indirect.

Fires, or rather the fear of them, are our greatest obstacle to the practice of forestry in this State, and on the practice of forestry depends the continued existence of our lumber industry. Approach an owner of woodland and urge on him a certain forestry operation, and what will be his reply? "Oh, yes, what you say is true enough, but how am I to know that my woodlands will not burn up next year?"

Our lumber industry is more important than people realize. Our annual cut amounts to nearly 500,000,000 feet. For this lumber there is paid to the landowner \$2,500,000, and there is paid out in labor to harvest this crop at least \$1,000,000 more. These figures deal only with conversion of the trees into rough lumber, and have nothing to do with the further conversion of this lumber into boxes, furniture and the thousand and one articles into which our raw lumber is made. Unless we can induce our land owners to take up the proper management of our forests, this important industry is sure to be wiped out, and there is nothing which will give more encouragement to the proper management of our woodlands than the reasonable protection of them from fire. To this end we have labored hard to build up an effective forest fire protective system, and I desire to take this opportunity to express to you my appreciation of the splendid support that has been given by this association to Mr. Hutchins, the State Fire Warden, and his four district men who have been in direct charge of this work.

It may be of interest to some of you to know just what our forest-fire organization consists of. The State Fire Warden, who has supervision of the work, is assisted by four district fire wardens who are supplied with runabout automobiles. These men are charged with the supervision of the observation stations within their district, and are also continually patrolling the towns comprising their district, instructing the forest wardens and their deputies relative to their duties, assisting in extinguishing fires, visiting the selectmen and impressing upon them the importance of better equipping their towns with equipment for handling forest fires, and towns with a valuation of \$1,500,000 or under, the advisability of taking advantage of the reimbursement act, whereby the State will reimburse such towns one-half for forest-fire equipment that they may purchase, the State's share not to exceed \$250, and to be approved by the forestry department.

We also have an inspector who devotes his entire time to inspecting locomotives and portable saw mills. Several hundred locomotives have been inspected, and the reports show that while they were all equipped with spark arresters, as required by law, in many cases these devices were so thoroughly out of repair as to make them absolutely useless. We have also at the present time 23 observation stations established in the Commonwealth, 4 new steel towers having been built this year as follows: Manchester, Wakefield, North Hanson and Bournedale, temporary towers

being built at Savoy and Pelham. These towers are all equipped with maps, field glasses and telephone which connects with over 1,800 forest wardens and deputies, the observers in charge being local men in nearly every instance, who are thoroughly familiar with the surrounding territory.

While we have had nearly 3,000 fires reported from these stations to the different wardens, we have had very few serious fires, notably, the Freetown, Bourne, Yarmouth and Shutesbury fires which were allowed to burn for days. These fires were practically extinguished the first day, but were left at night without sufficient help to control, only to start up the second day, unnecessary back fires being set that were soon beyond control.

One matter which I deem of vital importance, and to which I desire to call your attention, is the necessity of a law which will provide for a reasonable disposition of the slash or brush which is now left on the ground following wood and lumber operations. I might state here that the two or three serious fires which I have referred to would have been impossible had it not been for the fact that where they occurred hundreds of acres of this slash had been left, so extinguishment was made almost an impossibility. For several years I have recommended in my annual report to the Legislature the imperative need of a law which would obviate this condition, but no action has yet been taken. The incoming Legislature will again be asked to consider the same subject, and I desire to say here that your organization can render no more valuable service to the State Forestry Department than by sending representatives before the proper committees of the Legislature to urge the passage of the bill.

THE FIFTH NATIONAL CONSERVATION CONGRESS.

The conservation of our natural resources and their proper use constitutes a problem of gigantic proportions upon the wise solving of which depends very largely the abiding prosperity of the nation. Of such vital importance was it considered by Theodore Roosevelt, that in May, 1908, he called together in convention the Governors of all the States of the Union to consider the question of how best to bring about a reform of the present wasteful methods of production and utilization of our natural resources, such as minerals, timber, water power, soils, in fact, all the natural wealth with which we as a nation are so richly endowed, to the end that their benefits may be shared equally among all the people, and that there may be transmitted a practically undiminished capital to the generations to come. As a result of that conference there was organized the National Conservation Congress, and the conservation senti-



A view of sprayed and unsprayed trees on the North Shore. The modern high-power solid stream sprayer has revolutionized the work of spraying woodlands. One thorough spraying has held the foliage against very adverse conditions, as shown at the left.

ment was crystalized into a nation-wide movement. Chief among the objects for which the National Conservation Congress was created, as annunciated in its declaration of principles, is to "afford an agency through which the people of the country may frame policies and principles affecting the conservation and utilization of their resources, to be put into effect by their representatives in State and federal governments." This year's congress convened at Washington, D. C., on November 17, and its sessions lasted through four days. The official delegates appointed by the Governor to represent Massachusetts at this congress were State Forester F. W. Rane and Sec. C. O. Bailey. Its discussions were devoted largely to forest conservation because of the national importance of the subject in its many phases. Practically all the leading foresters of the United States were in attendance, and the discussions on the various branches of forestry were of great value to those who were privileged to hear them.

NEW LEGISLATION.

The following bills relating to forestry were enacted at the last session of the General Court and were intended to advance the forestry interests of the Commonwealth:—

Forest Taxation.

Reference was made in the last annual report of the adoption by the voters of the State of an amendment to the Constitution relative to the taxation of wild or forest lands. This action was taken at the election in 1912, following which the Legislature of 1913 passed the following resolve:—

ACTS OF 1913, CHAPTER 131.

RESOLVE TO PROVIDE FOR THE APPOINTMENT OF A COMMISSION TO INVESTIGATE AND REPORT UPON THE TAXATION OF WILD OR FOREST LANDS.

Resolved, That the governor, with the advice and consent of the council, shall, within thirty days after the passage of this resolve, appoint a commission of five persons, citizens of the commonwealth, to be known as the commission on the taxation of wild or forest lands. Said commission shall investigate the effect of the present laws relating to the taxation of wild or forest lands in this commonwealth, and the laws and systems of taxation of such lands in operation in other states and countries, shall correspond

so far as may be advisable with authorities in this commonwealth and in other states and countries in regard to said matters, and shall draft an act providing such methods of taxation of wild or forest lands as will develop and conserve the forest resources of the commonwealth. The said commission shall also investigate the present policy of the commonwealth with regard to the acquisition and management of wild or forest lands and report what further legislation, if any, is necessary. The report shall also contain a compilation of statistics and other information obtained by the commission and shall be made on or before the first Wednesday in January, nineteen hundred and fourteen. Of the said commissioners, one member shall be the tax commissioner and one member shall be the state forester. The members of the commission shall serve without compensation, but may incur such expenses in the performance of their duties, not exceeding the amount of five thousand dollars, as may be authorized by the governor and council. The commission shall be provided with suitable quarters in the state house or elsewhere. *[Approved June 16, 1913.]*

Acting under the authority given him by this resolve, the Governor appointed, as members of this commission, the State Tax Commissioner, W. D. T. Trefry, the State Forester, F. W. Rane, as required by the resolve, Mr. Harold Parker, ex-chairman of the Massachusetts Highway Commission, Prof. C. J. Bullock, professor of economics at Harvard University and Mr. Charles H. Preston of Danvers. The commission promptly organized with Tax Commissioner Trefry as chairman, and immediately entered upon its duties. Public hearings were advertised and held in the following places: October 31, at the State House; November 5, at Greenfield; November 6, at Springfield; November 7, at Pittsfield; November 14, at Worcester; November 21, at the State House; November 28, at Middleborough.

Nearly all of these hearings were largely attended, and the commission acquired very much valuable information and data bearing upon the problem given it to solve.

Moth Superintendent and Forest Warden Appointments changed.

The importance of beginning moth suppression operations as early as possible in each year with a thoroughly organized force of men in every city and town where such work is necessary, also to allow for sufficient time to instruct forest wardens with regard to the prevention and extinguishment of forest fires be-

fore the dry and dangerous periods occur, were the reasons for changing the time of making the appointment of local moth superintendent and forest warden from March or April to January.

ACTS OF 1913, CHAPTER 6.

AN ACT RELATIVE TO THE TIME OF APPOINTMENT OF LOCAL SUPERINTENDENTS FOR THE SUPPRESSION OF GYPSY AND BROWN TAIL MOTHS AND RELATIVE TO THE APPOINTMENT OF FOREST WARDENS.

Be it enacted, etc., as follows:

SECTION 1. Section sixteen of chapter thirty-two of the Revised Laws, as amended by section one of chapter four hundred and seventy-five of the acts of the year nineteen hundred and seven, is hereby further amended by striking out the words "March or April", in the third line, and inserting in place thereof the word: — January, — so as to read as follows: — *Section 16.* The mayor and aldermen in cities and the selectmen in towns shall annually, in January, appoint a forest warden, and they shall forthwith give notice of such appointment to the state forester. The appointment of a forest warden shall not take effect unless approved by the state forester, and when so approved notice of the appointment shall be given by the mayor and aldermen or by the selectmen to the person so appointed and approved. Whoever having been duly appointed fails within seven days after the receipt of such notice to file with the city or town clerk his acceptance or refusal of the office shall, unless excused by the mayor and aldermen or by the selectmen, forfeit ten dollars. Nothing in this act or in any other act shall be construed to prevent the offices of tree warden, selectman, chief of fire department and forest warden from being held by the same person.

SECTION 2. Section four of chapter three hundred and eighty-one of the acts of the year nineteen hundred and five, as amended by section two of chapter two hundred and sixty-eight of the acts of the year nineteen hundred and six, and by section one of chapter five hundred and twenty-one of the acts of the year nineteen hundred and seven, and by chapter one hundred and fifty of the acts of the year nineteen hundred and ten, is hereby further amended by striking out the words "March or April", in the third line, and inserting in place thereof the word: — January, — so as to read as follows: — *Section 4.* The mayor and aldermen in cities and the selectmen in towns shall annually in the month of January appoint a local superintendent for the suppression of gypsy and brown tail moths. Said superintendents shall, under the advice and general direction of the state forester, destroy the eggs, caterpillars, pupæ and nests of the gypsy and brown tail moths within their limits, except in parks and other property under the control of the commonwealth, and except in private property, save as otherwise provided herein. The appointment of a local superintendent shall not take effect unless approved by the state forester, and when so approved, notice of the appointment shall be given by the

mayor and aldermen or the selectmen to the person so appointed. When any city or town shall have expended within its limits city or town funds to an amount in excess of five thousand dollars in any one fiscal year, in suppressing gypsy or brown tail moths, the commonwealth shall reimburse such city or town to the extent of fifty per cent of such excess above said five thousand dollars.

SECTION 3. This act shall take effect on the first day of January, nineteen hundred and fourteen. [*Approved May 2, 1913.*]

Furnishing Arsenate of Lead at Cost.

As a further aid to property owners in the suppression of gypsy and brown-tail moths, a bill was passed by the General Court, giving authority to local superintendents in such towns as are receiving aid from the State to furnish arsenate of lead to property owners at a price not to exceed the cost to the State.

The act reads as follows: —

AN ACT TO AUTHORIZE LOCAL MOTH SUPERINTENDENTS TO FURNISH ARSENATE OF LEAD TO REAL ESTATE OWNERS.

Be it enacted, etc., as follows:

SECTION 1. For the purpose of assisting in the extermination of gypsy and brown tail moths, the local moth superintendent in any city or town now receiving aid from the commonwealth, in suppressing the said insect pests is hereby authorized to furnish, at the cost thereof, arsenate of lead to any owner of real estate situated within the limits of such city or town. Material purchased under the provisions hereof shall be used only for the suppression of gypsy and brown tail moths and only upon land of the purchaser.

SECTION 2. The amounts due for material furnished under the provisions of section one shall be charged by the local moth superintendent to the owners of private estates and shall be collected in the same manner as the amounts assessed for private work, and shall be a lien on said estates in the same manner as the assessments for private work. The amount thus charged shall be deducted from the total amount expended in each city or town in the suppression of the gypsy and brown tail moths in the same manner as the amounts charged for private work, as provided for in sections six and seven of chapter three hundred and eighty-one of the acts of the year nineteen hundred and five and its several amendments. [*Approved May 7, 1913.*]

Public Domain.

Taking cognizance of the great possibilities which lie in forestry as a means of adding to the wealth and prosperity of the State, the Massachusetts Forestry Association has devoted much

of its energy during the past year to organizing branch associations in various cities and towns of the Commonwealth, with the hope that an aroused local interest would result in the establishment of municipal forests in conformity to the public domain act as amended last year through the efforts of that association.

The act as amended follows:—

ACTS OF 1913, CHAPTER 564.

AN ACT RELATIVE TO PUBLIC DOMAIN.

Be it enacted, etc., as follows:

SECTION 1. Section twenty-three of chapter twenty-eight of the Revised Laws is hereby amended by striking out the word “a”, before the word “town”, in the second line, and inserting in place thereof the words:— an annual,— by inserting after the word “therefor”, in the eighth line, the words:— but the indebtedness so incurred shall be limited to an amount not exceeding one half of one per cent of the last preceding assessed valuation of the city or town,— and by striking out the words “commonwealth for the benefit of the”, in the eleventh line, so as to read as follows:— *Section 23.* A town, by a vote of two thirds of the legal voters present and voting at an annual town meeting, or a city in which the city council consists of two branches, by a vote of two thirds of the members of each branch, and a city in which there is a single legislative board, by a vote of two thirds of the members thereof, present and voting thereon, may take or purchase land within their limits, which shall be a public domain, and may appropriate money and accept gifts of money and land therefor; but the indebtedness so incurred shall be limited to an amount not exceeding one half of one per cent of the last preceding assessed valuation of the city or town. Such public domain shall be devoted to the culture of forest trees, or to the preservation of the water supply of such city or town and the title thereto shall vest in the city or town in which it lies.

SECTION 2. Said chapter twenty-eight is hereby further amended by striking out section twenty-five and inserting in place thereof the following:— *Section 25.* The city or town forester in each city or town, with one or more keepers appointed by him, shall have the management and charge of all such public domain in that city or town, and within such public domain shall have the powers of constables and police officers in towns. But a town by a vote of two thirds of the legal voters present and voting at an annual town meeting, or a city in which the city council consists of two branches, by a vote of two thirds of the members of each branch, and a city in which there is a single legislative board, by a vote of two thirds of the members thereof present and voting thereon, may place all such public domain within its limits under the general supervision and control of the state forester, who shall thereupon, upon notification thereof, make regulations for the care and use of such public domain and for the planting and cultivating of trees therein, and the city or town forester in such case and

his keepers, under the supervision and direction of the state forester, shall be charged with the duty of enforcing all such regulations and of performing such labor therein as may be necessary for the care and maintenance thereof; and within such public domain shall have the powers of constables and police officers in towns.

SECTION 3. Said chapter twenty-eight is hereby further amended by striking out section twenty-six and inserting in place thereof the following: — *Section 26.* Any such city or town may lease any building on a public domain, and shall apply all sums derived from rents or from the sale of the products of any such domain, so far as may be necessary, to the management thereof.

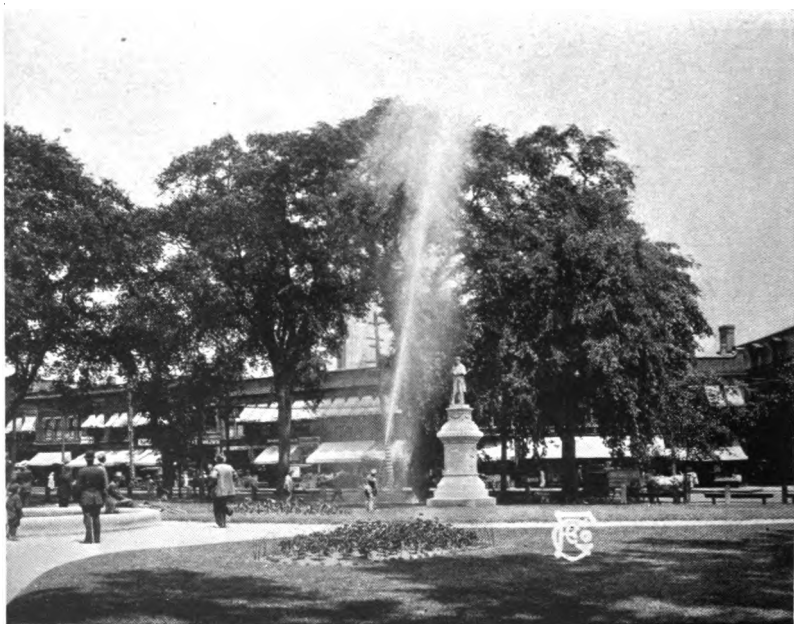
SECTION 4. Said chapter twenty-eight is hereby further amended by striking out section twenty-seven and inserting in place thereof the following: — *Section 27.* Any city or town in which such public domain is situated may erect thereon any building for public instruction or recreation: *provided*, that if such public domain has been placed under the supervision and control of the state forester, under the provisions of this act, no such building shall be erected unless his approval shall first be obtained.

SECTION 5. Said chapter twenty-eight is hereby further amended by striking out section twenty-nine and inserting in place thereof the following: — *Section 29.* For the purpose of defraying the expenses incurred under the provisions of the six preceding sections any city or town may issue from time to time, and to an amount not exceeding the sum actually expended for the taking or purchase of lands for such public domain, bonds or notes. Such bonds or notes shall be denominated on the face thereof, City or Town of _____, Public Domain Loan, Act of 1913; shall be payable by such annual payments, beginning not more than one year after the date thereof, as will extinguish each loan within thirty years from its date; and the amount of such annual payment of any loan in any year shall not be less than the amount of the principal of said loan payable in any subsequent year. Each authorized issue of bonds or notes shall constitute a separate loan. The bonds or notes shall bear interest at a rate not exceeding four and one half per cent per annum, payable semi-annually; and shall be signed by the treasurer and countersigned by the mayor of the city or, in the case of a town, shall be signed by the treasurer and countersigned by the selectmen. The city, by its mayor and treasurer, and the town, by its selectmen and treasurer, may sell such bonds or notes at public or private sale, upon such terms and conditions as they may deem proper, but the bonds or notes shall not be sold for less than their par value; and the proceeds shall be used only for the purposes herein specified.

SECTION 6. The city or town shall at the time of authorizing said loan or loans provide for the payment thereof in accordance with the foregoing provisions of this act; and when a vote to that effect has been passed by the city council, or at any annual town meeting, a sum which will be sufficient to pay the interest as it accrues on the bonds or notes issued as aforesaid by the city or town, and to make such payments on the principal as



The main street at Nantucket. We think of the island of Nantucket as lacking in tree growth. It is largely a question of soil and wind protection. It is believed that with wind breaks of the hardier growing species, and by taking advantage of natural shelters, much of the island could be gradually reforested.



Spraying tall trees in the Taunton public square with the solid stream high-power sprayer, which was brought out originally by this department. Most of the principal towns and cities where the gypsy and brown-tail moths prevail have these power sprayers.

may be required under the provisions of this act, shall, without further vote, be assessed by the assessors of the city or town annually thereafter, in the same manner in which other taxes are assessed, until the debt incurred by said loan or loans is extinguished.

SECTION 7. This act shall take effect upon its passage. [Approved April 26, 1913.]

FINANCIAL STATEMENTS.

General Forestry.

In accordance with section 6, chapter 409 of the Acts of 1904, as amended by section 1, chapter 473, Acts of 1907, the following statement is given of the forestry expenditure for the year ending Nov. 30, 1913:—

State Forester's Expenses.

Appropriation for 1913,		\$20,000 00
Expenditures:—		
Salaries of assistants,	\$7,631 69	
Traveling expenses,	3,246 84	
Stationery and postage, etc.,	708 13	
Printing,	723 72	
Maps,	198 15	
Equipment,	246 87	
Sundries,	285 30	
Nursery account:—		
Pay roll,	5,231 10	
Travel,	59 61	
Equipment,	700 68	
Teaming, express and freight,	715 39	
Telephone, water, gasoline, dynamite, etc.,	252 25	
		19,999 73
Balance returned to treasury,		\$0 27

Purchase and Planting of Forest Lands.

Appropriation for 1913,		\$10,000 00
Expenditures:—		
Pay roll,	\$6,604 35	
Travel,	480 04	
Tools and equipment,	324 54	
Express and teaming,	288 78	
Land,	2,138 75	
Stationery and postage,	141 03	
Sundries,	22 35	
		9,999 84
Balance returned to treasury,		\$0 16

Prevention of Forest Fires.

Appropriation for 1913,	\$20,000 00	
Receipts: —		
Spofford estate,	200 00	
Protest on Spofford check,	1 35	
Wm. D. Sohier,	400 00	
Town of Wakefield,	350 00	
Town of Halifax,	50 00	
Town of Plympton,	75 00	
Town of Hanson,	100 00	
Town of Duxbury,	100 00	
Town of Whitman,	75 00	
Town of Hanover,	100 00	
Town of Marshfield,	50 00	
Town of Bourne,	300 00	
Town of Wareham,	150 00	
Town of Sterling,	18 75	
Town of Dunstable,	11 81	
Town of Ashland,	11 50	
Wm. D. Sohier, agent,	500 00	
Town of Upton,	12 50	
New England Telephone and Telegraph Com- pany,	23	
		\$22,506 14
Expenditures: —		
Salaries,	\$11,301 60	
Travel,	4,262 42	
Printing,	538 32	
Stationery and postage,	256 38	
Equipment,	2,568 69	
Construction,	1,877 62	
Telephone,	1,275 90	
Express,	59 51	
Sundries,	365 52	
		22,505 96
Balance returned to treasury,		\$0 18
Reimbursement for fire-fighting apparatus to towns,		\$5,012 48

Suppression of Gypsy and Brown-tail Moths.

The balance shown on the general appropriation for the suppression of the gypsy and brown-tail moths, as carried at the end of the fiscal year, will be all practically expended in reimbursements to towns and cities for the work of the year ending Nov. 30, 1913.

General Appropriation.

Balance on hand Nov. 30, 1912, . . .	\$103,174 00
Less reimbursement due for 1912, . . .	61,016 06

Balance for 1913 work, . . .	\$42,157 94
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Receipts:—

Appropriation for 1913 (made in 1912), . . .	75,000 00
Town of Easton,	270 33
Town of West Bridgewater,	234 44
City of Lowell,	22 14
Town of Andover,	194 23
Town of Hingham,	157 48
City of Medford,	411 85
Town of Lexington,	154 53
Town of Arlington,	1,117 83
Town of Stoneham,	106 21
Town of Westwood,	600 00
Town of Milton,	800 00
Appropriation for 1913,	125,000 00
Town of Milton,	854 75
Town of Westwood,	345 58
Town of Walpole,	600 00
Town of Wakefield,	959 48
For old truck sold,	85 00
Appropriation for 1914,	75,000 00
For motor cycles sold,	425 00
Town of Winchester,	985 38
Adams Express Company,	15
City of Quincy,	1,225 11
Special North Shore Fund,	7,644 06
Purchase and planting of forest lands,	6 58
State Forester's expenses,	34 15
Prevention of forest fires,	4 15
Dover gypsy moth fund,	204 95
Howe & French (paid in error),	20 25
Town of Holliston,	15 00
Town of Millis,	12 00
Town of Natick,	48 15
Town of Hopkinton,	683 86
	<hr/>
	\$335,380 58
<i>Amount carried forward,</i>	<hr/> \$335,380 58

Amount brought forward, \$335,380 58

Office expenses:—

Salaries of clerks,	\$2,741 59
Rent of offices,	2,139 98
Stationery and postage,	919 72
Printing,	840 09
Expert's services,	125 00
Office and laboratory supplies,	278 18
Forester's supplies,	66 67
Educational work,	40 91
Sundries,	864 81

Field expenses:—

Wages of employees,	28,688 83
Traveling expenses,	8,300 83
Tools and supplies,	120,463 68
Special work,	14,700 00
Rent of supply store,	749 60
Supply store equipment,	87 45
Sundries, including teaming,	754 33
Reimbursement towns and cities,	32,060 21

213,822 48

Balance on hand Nov. 30, 1913,	\$121,558 10
Reimbursement paid December, 1913, and January, 1914, for the year 1913,	48,471 60

Receipts:— *Special North Shore Fund.*

Balance from 1912,	\$3,682 05
South End Improvement Association of Rock- port,	500 00
F. W. Rane, State Forester,	500 00
Town of Rockport,	500 00
Whitcomb Carter Company refund,	60
F. W. Rane, State Forester,	1,200 00
W. D. Sohier, agent,	1,200 00
Town of Manchester,	5,000 00
F. W. Rane, State Forester,	10,000 00
W. D. Sohier, agent,	10,000 00
City of Beverly,	5,000 00
J. D. Barnes, for sprayer sold,	300 00
State Forester's expenses,	153 06
Pump and engine sold,	85 00
Transfer from appropriation for suppression of gypsy and brown-tail moths,	1,306 30
Wm. D. Sohier, for property owners,	2,427 66

\$41,854 67

Amount carried forward, \$41,854 67

Amount brought forward, \$41,854 67

Expenditures: —

Wages of employees,	\$18,944 98
Traveling expenses,	1,016 96
Rent,	310 00
Supplies,	9,670 63
Sundries, including teaming, etc.,	1,873 09
Storehouse equipment,	37 65
Stationery and postage,	1 35
Office supplies,	25
	<hr/>
	31,859 91

Balance on hand Nov. 30, 1913, \$9,999 76

The following is a list of towns and cities, with amount of supplies for moth work furnished for the year ending Nov. 30, 1913: —

Acton, ¹	\$2,148 73	Easton,	\$12 50
Andover,	911 31	Essex,	85 56
Arlington, ¹	2,330 99	Fitchburg,	1 87
Ashburnham,	209 75	Georgetown,	454 95
Ashby,	174 17	Gloucester,	213 83
Ashland, ¹	1,564 72	Greenfield,	2 01
Avon,	47 80	Groton,	535 07
Ayer, ¹	1,804 80	Groveland,	193 26
Bedford, ¹	3,057 36	Halifax,	12 91
Berkley,	43 80	Hamilton,	843 01
Berlin,	237 52	Hanover,	374 92
Billerica,	603 61	Hanson,	57 32
Bolton,	337 96	Harvard,	532 23
Boxborough,	584 29	Haverhill,	24
Boxford,	429 81	Hingham, ¹	2,711 66
Boylston,	118 28	Holden,	8 40
Braintree, ¹	2,355 76	Hopkinton,	89 23
Bridgewater, ¹	1,684 75	Hudson,	301 86
Burlington, ¹	2,020 54	Ipswich,	779 22
Canton,	772 83	Kingston,	361 94
Carlisle,	460 29	Lexington, ¹	2,461 24
Carver,	246 92	Lincoln, ¹	3,727 66
Chelmsford,	638 82	Littleton, ¹	1,964 62
Cohasset,	2,447 58	Lunenburg, ¹	1,855 53
Concord,	672 17	Lynnfield,	626 92
Danvers,	614 28	Marlborough,	854 12
Dedham, ¹	3,410 81	Marshfield,	798 24
Dover,	3 20	Mashpee,	286 74
Dracut,	320 54	Maynard, ¹	1,542 04
Dunstable,	140 24	Medfield,	2 00
Duxbury,	269 08	Medford,	1,040 94

¹ Received prayers from the State, agreeing to pay one-half the cost.

Merrimac,	\$215 10	Shrewsbury,	\$38 81
Methuen,	907 65	Southborough, ¹	1,459 70
Middleborough,	681 09	Sterling,	336 75
Middleton,	301 09	Stoneham,	688 48
Milton, ¹	4,302 76	Stow,	403 49
Natick,	87 80	Sudbury,	455 90
Newbury,	581 79	Templeton,	1 69
Newton,	9,849 28	Tewksbury,	598 20
Norfolk,	111 58	Topsfield,	194 85
North Andover,	538 20	Townsend,	286 69
North Reading,	1,344 45	Tyngsborough, ¹	2,228 41
Northborough, ¹	1,492 33	Waltham,	1,779 26
Norwell,	1,021 27	Wayland,	766 15
Pembroke,	63 60	Wakefield,	829 68
Pepperell,	422 93	Wellesley,	3 50
Plympton,	134 08	Wenham, ¹	1,589 19
Princeton,	1 80	West Bridgewater,	277 02
Quincy,	1,146 64	West Newbury,	318 45
Raynham,	61 23	Westborough, ¹	1,850 17
Reading,	1,464 88	Westford,	1,046 41
Rochester,	29 35	Westminster,	102 66
Rowley,	246 50	Weston, ¹	3,700 90
Royalston,	3 90	Weymouth, ¹	2,360 53
Salisbury,	304 22	Wilmington, ¹	2,586 52
Sandwich,	139 99	Winchendon,	179 17
Saugus,	763 79	Wilbraham,	39
Scituate, ¹	4,511 70	Woburn,	1,418 76
Sherborn,	333 55		
Shirley,	313 83		
			\$110,273 76

Dover gypsy moth fund,	111 20
Forestry department,	48 63
Forest fire prevention,	16 99
Thinning work equipment,	78 19
Special North Shore Fund,	7,644 06
Pine Banks,	173 25
Reforestation,	6 58
Traveling pump,	14 63
Traveling sprayer, (1),	18 50
Traveling sprayer, (2),	393 14
Traveling sprayer, (3),	572 41
Traveling sprayer, (4),	196 51
Traveling sprayer, (5),	182 09
Traveling sprayer, (6),	75 00
Traveling sprayer, (7),	476 48
Traveling sprayer, (8),	612 27
Traveling sprayer, (9),	72 50
Truck,	4 37
United States Department of Agriculture,	3 72
Repairs on automobiles,	402 67
	\$121,376 95

¹ Received sprayers from the State, agreeing to pay one-half the cost.

FINANCIAL SUMMARY OF MOTH WORK BY TOWNS.

The following table shows the reimbursement paid to cities and towns for the year 1912, the total net expenditure, the required expenditure before receiving reimbursement from the State, the amount received for work on private property returned to this office, and the amount of reimbursement paid for 1913, and also the required expenditure for 1914. Towns marked with an asterisk received supplies from this office.

CITIES AND TOWNS.	1912. Re- imburse- ment.	1913.				1914. Required Expendi- ture.
		Required Expendi- ture.	Total Net Expendi- ture.	Private Work.	Re- imburse- ment.	
Abington,	-	\$1,361 05	-	-	-	\$1,403 51
Acton,	\$997 85*	970 13	\$2,120 13	\$320 44	\$550 00*	975 90
Acushnet,	-	402 86	-	-	-	439 31
Amesbury,	-	2,615 03	1,809 64	1,045 60	-	2,626 67
Andover,	-*	2,383 11	2,855 09	1,523 99	-*	3,234 59
Arlington,	-*	5,000 00	4,985 65	1,546 98	-*	5,000 00
Ashburnham,	104 75*	488 17	919 20	445 19	431 03*	500 72
Ashby,	233 48*	239 32	506 52	69 50	271 97*	248 18
Ashland,	243 78*	585 00	570 61	270 96	-*	600 12
Athol,	-	2,216 99	-	-	-	2,342 62
Attleborough,	-	5,000 00	-	-	-	5,000 00
Auburn,	-	554 00	-	-	-	634 80
Avon,	122 02*	414 70	589 90	62 30	175 20*	431 88
Ayer,	-	922 45	1,410 09	67 35	-*	927 85
Barnstable,	-	3,175 20	-	-	-	3,370 26
Barre,	-	1,001 02	-	-	-	1,053 58
Bedford,	2,296 80*	667 80	2,661 43	1,781 28	1,393 63*	716 31
Bellingham,	-	383 65	-	-	-	382 26
Belmont,	-	3,015 78	2,070 04	-	-	3,297 49
Berkley,	97 22*	165 77	234 05	57 40	68 28*	208 21
Berlin,	1,009 27*	243 10	1,018 89	367 27	775 79*	249 31
Beverly,	-	5,000 00	4,661 05	-	-	5,000 00
Billerica,	854 89*	1,132 00	1,207 41	728 51	75 41*	1,385 80
Blackstone,	-	948 29	-	-	-	968 97
Bolton,	872 76*	258 98	1,033 93	227 27	774 95*	271 59
Boston,	20,000 00	5,000 00	49,332 73	15,025 52	9,849 89	5,000 00

CITIES AND TOWNS.	1912. Re- imburse- ment.	1913.				1914. Required Expendi- ture.
		Required Expendi- ture.	Total Net Expendi- ture.	Private Work.	Re- imburse- ment.	
Bourne,	-	\$2,881 49	-	-	-	\$3,057 72
Boxborough,	\$1,321 99*	116 41	\$1,464 91	\$239 28	\$1,348 50*	117 39
Boxford,	2,052 20*	610 32	2,015 65	400 92	1,405 33*	614 49
Boylston,	-*	207 40	734 53	310 67	527 13*	212 02
Braintree,	-	3,163 39	3,927 33	995 56	-*	3,495 80
Brewster,	-	354 44	-	-	-	325 23
Bridgewater,	-	1,447 26	2,139 56	211 69	92 30*	1,543 15
Brockton,	-	5,000 00	-	-	-	5,000 00
Brookfield,	-	541 40	-	-	-	545 63
Brookline,	-	5,000 00	-	-	-	5,000 00
Burlington,	1,496 58*	310 18	1,947 98	205 05	1,037 80*	316 41
Cambridge,	-	5,000 00	-	-	-	5,000 00
Canton,	686 36*	2,133 36	3,600 86	1,591 25	800 00*	2,543 23
Carlisle,	2,792 25*	191 37	2,741 29	364 03	2,549 92*	199 17
Carver,	489 82*	770 99	1,394 70	591 11	623 71*	790 28
Charlton,	-	522 40	-	-	-	518 93
Chelmsford,	500 71*	1,753 60	1,828 15	1,009 28	74 55*	1,785 87
Chelsea,	-	5,000 00	-	-	-	5,000 00
Clinton,	-	3,632 43	2,469 94	-	-	3,661 51
Cohasset,	1,011 89*	3,802 02	4,578 72	2,600 54	131 85*	4,417 09
Concord,	1,105 28*	3,372 27	3,998 89	1,825 72	366 87*	3,520 46
Danvers,	1,297 13*	2,792 62	3,952 56	1,614 47	805 10*	3,016 55
Dartmouth,	-	1,841 43	-	-	-	2,007 73
Dedham,	-	5,000 00	6,090 84	2,578 71	-*	5,000 00
Dennis,	-	530 67	-	-	-	545 11
Dighton,	-	527 86	-	-	-	548 88
Douglas,	-	551 50	-	-	-	526 50
Dover,	-	2,515 57	2,638 12	916 67	97 40*	3,079 54
Dracut,	297 32*	1,013 87	1,585 99	1,159 04	576 66*	1,008 01
Dudley,	-	794 74	-	-	-	825 65
Dunstable,	796 71*	170 36	904 14	335 33	733 78*	171 65
Duxbury,	257 70*	1,268 83	1,578 55	824 24	309 72*	1,764 16
East Bridgewater, . .	56 54*	903 05	578 87	257 55	-	945 66
Easton,	-*	2,408 14	-	-	-*	2,792 83
Essex,	603 31	496 97	1,095 75	402 50	598 78*	501 86
Everett,	-	5,000 00	1,014 19	-	-	5,000 00
Fall River,	-	5,000 00	-	-	-	5,000 00

CITIES AND TOWNS.	1912. Re- imburse- ment.	1913.				1914. Required Expendi- ture.
		Required Expendi- ture.	Total Net Expendi- ture.	Private Work.	Re- imburse- ment.	
Fairhaven,	-	\$1,554 84	-	-	-	\$1,631 10
Falmouth,	-	4,718 70	-	-	-	4,341 80
Fitchburg,	-*	5,000 00	-	-	-*	5,000 00
Foxborough,	-	1,033 04	-	-	-	1,059 05
Framingham,	-	5,000 00	\$4,067 73	-	-	5,000 00
Franklin,	-	1,773 40	-	-	-	1,880 97
Freetown,	-	397 86	-	-	-	407 73
Gardner,	-	4,005 63	-	-	-	4,195 02
Georgetown,	\$1,458 48*	498 01	1,595 64	\$734 60	\$1,097 63*	509 37
Gloucester,	1,623 07*	5,000 00	6,872 77	1,971 97	829 48*	5,000 00
Grafton,	-	1,168 22	727 22	250 00	-	1,219 66
Great Barrington,	-	2,536 84	-	-	-	2,749 12
Greenfield,	-	4,324 33	-	-	-*	4,597 02
Groton,	76 95*	1,645 19	1,692 70	379 45	47 51*	1,735 29
Groveland,	920 33*	486 64	1,155 93	292 72	669 29*	492 33
Halifax,	438 40*	260 10	781 79	471 81	521 69*	262 17
Hamilton,	1,035 53*	1,874 57	2,668 86	881 90	400 00*	2,060 78
Hanover,	857 97*	638 09	1,370 22	1,169 59	732 13*	784 20
Hanson,	916 36*	551 32	1,111 05	189 68	559 73*	580 61
Harvard,	533 78*	680 53	1,560 37	938 29	879 84*	702 06
Harwich,	-	595 06	-	-	-	627 67
Haverhill,	-	5,000 00	4,009 55	1,998 35	-*	5,000 00
Hingham,	-*	3,116 37	3,752 18	3,260 55	-*	3,281 43
Holbrook,	-	639 20	-	-	-	661 97
Holden,	-	712 78	929 92	428 16	217 14*	725 84
Holliston,	-	787 43	-	-	-	807 10
Hopedale,	-	2,365 45	-	-	-	2,388 25
Hopkinton,	-*	702 60	1,289 72	440 00	587 12*	727 08
Hubbardston,	-*	307 48	457 81	156 13	150 33	315 47
Hudson,	240 65*	1,618 63	1,818 20	648 83	199 57*	1,659 29
Hull,	-	3,039 23	-	-	-	3,258 48
Ipswich,	24 40*	2,295 12	2,703 75	1,325 40	408 63*	2,196 02
Kingston,	224 05*	660 18	2,001 61	446 73	1,341 43*	671 96
Lakeville,	-	426 08	-	-	-	464 75
Lancaster,	-*	2,140 57	-	-	-	2,744 58
Lawrence,	-	5,000 00	1,912 30	-	-	5,000 00
Leicester,	-	972 41	-	-	-	1,002 99

CITIES AND TOWNS.	1912. Re- imburse- ment.	1913.				1914. Required Expendi- ture.
		Required Expendi- ture.	Total Net Expendi- ture.	Private Work.	Re- imburse- ment.	
Lenox,	-*	\$3,133 87	-	-	-	\$3,585 22
Leominster,	-	5,000 00	-	-	-	5,000 00
Lexington,	\$2,548 47*	3,242 41	\$6,624 66	\$1,669 33	\$1,723 83*	3,425 04
Lincoln,	448 27*	1,615 75	2,136 55	2,064 92	-*	1,751 04
Littleton,	876 73*	467 68	1,380 54	99 50	312 86*	477 62
Lowell,	-*	5,000 00	3,165 04	3,752 97	-	5,000 00
Lunenburg,	866 44*	534 53	1,623 79	936 84	489 26*	557 11
Lynn,	-*	5,000 00	2,532 69	-	-	5,000 00
Lynnfield,	1,189 29*	479 72	2,461 49	514 53	1,981 77*	507 20
Malden,	-	5,000 00	-	-	-	5,000 00
Manchester,	-	5,000 00	-	-	-	5,000 00
Mansfield,	-	1,672 18	-	-	-	1,768 66
Marblehead,	-	4,079 57	1,633 00	1,547 63	-	3,764 06
Marion,	-	2,065 46	-	-	-	2,066 85
Marlborough,	-*	4,278 62	4,834 20	2,787 64	141 49*	4,289 75
Marshfield,	442 17*	1,064 55	1,723 55	1,188 26	659 00*	1,129 52
Masspee,	750 73*	97 38	1,426 96	110 80	1,328 06*	100 03
Mattapoisett,	-	798 62	-	-	-	740 39
Maynard,	-	1,632 04	2,152 75	313 72	-*	1,637 82
Medfield,	-	676 33	-	-	-*	726 81
Medford,	-*	5,000 00	3,910 42	2,202 71	-*	5,000 00
Medway,	-	686 51	-	-	-	688 73
Melrose,	-	5,000 00	-	-	-	5,000 00
Mendon,	-	275 44	-	-	-	277 51
Merrimac,	1,037 27*	535 89	1,312 69	333 96	776 80*	513 78
Methuen,	373 57*	3,194 64	3,621 26	2,552 70	159 77*	3,360 68
Middleborough,	693 12*	1,939 92	2,709 92	945 03	770 00*	1,993 88
Middleton,	1,289 32*	354 60	1,403 53	324 40	1,043 93*	364 61
Milford,	-	3,954 62	-	-	-	4,029 46
Millbury,	-	1,193 41	-	-	-	1,186 66
Millis,	-	539 09	147 93	-	-	547 23
Milton,	-	5,000 00	4,520 46	9,875 27	-*	5,000 00
Nahant,	-	3,673 72	-	-	-	3,627 12
Natick,	-*	3,470 07	3,070 81	1,658 54	-*	3,536 28
Needham,	-	2,926 47	- ¹	-	-	3,110 46
New Bedford,	-	5,000 00	-	-	-	5,000 00
New Braintree,	-	161 38	-	-	-	169 27

¹ This town has not yet filed complete account.

CITIES AND TOWNS.	1912. Re- imburse- ment.	1913.				1914. Required Expendi- ture.
		Required Expendi- ture.	Total Net Expendi- ture.	Private Work.	Re- imburse- ment.	
New Salem, . . .	-	\$148 72	-	-	-	\$157 08
Newbury, . . .	\$1,137 70*	627 06	\$1,997 17	\$687 61	\$1,370 11*	604 09
Newburyport, . . .	-	5,000 00	-	-	-	5,000 00
Newton, . . .	2,944 37*	5,000 00	25,032 88	16,942 86	2,000 00*	5,000 00
Norfolk, . . .	236 44*	418 44	549 15	298 20	130 71*	479 08
North Andover, . . .	364 58*	2,211 81	2,309 91	1,025 51	98 10*	2,229 00
North Attleborough, . . .	-	3,665 74	-	-	-	3,828 41
North Brookfield, . . .	-	753 92	-	-	-	765 08
North Reading, . . .	1,928 94*	354 10	2,632 48	780 52	2,278 38*	367 70
Northborough, . . .	789 91*	566 66	1,245 03	383 68	78 37*	738 19
Northbridge, . . .	-	2,086 30	-	-	-	2,210 49
Norton, . . .	-	601 74	-	-	-	675 10
Norwell, . . .	403 35*	446 38	1,035 11	1,470 39	588 73*	462 94
Norwood, . . .	-	5,000 00	-	-	-	5,000 00
Oakham, . . .	-	152 32	-	-	-	151 92
Orange, . . .	-	1,652 94	-	-	-	1,622 09
Orleans, . . .	-	765 33	-	-	-	1,478 52
Oxford, . . .	-	820 58	-	-	-	825 79
Palmer, . . .	-	1,934 07	-	-	-	2,115 60
Paxton, . . .	-*	153 36	-	-	-	158 87
Peabody, . . .	1,685 79	5,000 00	-	-	-	5,000 00
Pembroke, . . .	1,366 09*	390 54	1,846 51	353 78	1,455 97*	434 81
Pepperell, . . .	480 70*	907 45	1,912 19	484 90	1,004 74*	926 75
Petersham, . . .	-	442 07	-	-	-	444 60
Phillipston, . . .	-*	114 78	-	-	-	116 14
Plainville, . . .	-	342 66	-	-	-	414 68
Plymouth, . . .	-	4,886 83	-	-	-	5,000 00
Plympton, . . .	1,500 53*	166 26	1,670 26	204 83	1,503 90*	174 25
Princeton, . . .	-*	568 21	-	-	-*	596 48
Provincetown, . . .	-	915 41	-	-	-	944 17
Quincy, . . .	-*	5,000 00	5,662 91	1,130 40	-*	5,000 00
Randolph, . . .	-	1,092 40	-	-	-	1,129 50
Raynham, . . .	452 11*	354 45	317 03	214 54	-*	365 10
Reading, . . .	423 28*	2,618 75	3,151 64	1,997 70	133 33*	2,788 71
Rehoboth, . . .	-	385 80	-	-	-	411 04
Revere, . . .	-	5,000 00	-	-	-	5,000 00
Rochester, . . .	-	379 92	-	-	-*	383 62

CITIES AND TOWNS.	1912. Re- imburse- ment.	1913.				1914. Required Expendi- ture.
		Required Expendi- ture.	Total Net Expendi- ture.	Private Work.	Re- imburse- ment.	
Rockland,	-	\$1,931 05	-	-	-	\$2,001 52
Rockport,	\$446 56*	1,512 99	\$1,826 71	\$1,192 91	\$313 72	1,563 59
Rowley,	696 07*	968 80	1,188 87	229 34	220 07*	919 07
Royalston,	-*	278 44	95 36	61 58	-*	288 25
Rutland,	-	312 59	-	-	-	342 78
Salem,	-	5,000 00	-	-	-	5,000 00
Salisbury,	1,265 29*	535 99	1,434 90	304 00	896 91*	571 86
Sandwich,	157 79*	473 83	769 64	115 00	295 81*	530 32
Saugus,	2,956 42*	2,537 20	4,976 05	2,466 83	1,796 32*	2,670 32
Scituate,	4,046 37*	2,052 80	6,297 85	1,600 00	3,045 05*	2,218 48
Seekonk,	-	635 77	-	-	-	659 45
Sharon,	-	1,237 25	-	-	-	1,487 41
Sherborn,	299 13	644 53	792 41	1,203 44	147 83*	892 70
Shirley,	-*	501 98	542 81	79 80	40 83*	505 28
Shrewsbury,	-*	960 50	-	-	-*	1,001 17
Somerset,	-	632 85	-	-	-	659 68
Somerville,	-	5,000 00	662 99	1,709 09	-	5,000 00
Southborough,	682 26*	822 60	1,323 52	967 04	-*	856 04
Spencer,	-	1,459 18	-	-	-	1,408 47
Springfield,	-	5,000 00	-	-	-	5,000 00
Sterling,	-*	493 86	490 28	245 19	-*	499 84
Stockbridge,	-	1,813 78	-	-	-	1,703 57
Stoneham,	-*	2,104 35	2,057 23	1,478 32	-*	2,140 83
Stoughton,	-*	1,557 35	-	-	-	1,610 80
Stow,	918 38*	424 82	1,204 67	410 25	779 85*	448 54
Sturbridge,	-	407 65	-	-	-	372 80
Sudbury,	890 62*	544 28	1,722 49	220 83	1,178 21*	558 91
Sutton,	-	618 05	-	-	-	611 92
Swampscott,	-	4,955 16	4,455 68	-	-	5,000 00
Swansea,	-	662 11	-	-	-	706 68
Taunton,	-	5,000 00	-	-	-	5,000 00
Templeton,	-	729 96	-	-	-*	734 77
Tewksbury,	594 76*	605 54	1,405 52	687 29	799 98*	645 83
Topsfield,	637 05*	1,243 95	1,581 80	730 56	337 55*	1,427 43
Townsend,	387 20*	538 96	1,620 65	447 88	1,081 69*	546 91
Truro,	-	157 91	-	-	-	163 22
Tyngsborough,	823 98*	262 14	1,599 63	907 78	737 49*	269 96

CITIES AND TOWNS.	1912. Re- imburse- ment.	1913.				1914. Required Expendi- ture.
		Required Expendi- ture.	Total Net Expendi- ture.	Private Work.	Re- imburse- ment.	
Upton,	-	\$474 22	-	-	-	\$504 47
Uxbridge,	-	1,413 00	-	-	-	1,503 98
Wakefield,	-*	4,372 26	\$1,129 86	\$2,562 65	-*	4,602 40
Walpole,	-*	2,573 82	-	-	-	2,762 19
Waltham,	\$238 80*	5,000 00	7,297 71	5,875 19	\$259 23*	5,000 00
Wareham,	-	2,212 11	-	-	-	2,218 48
Warren,	-	840 79	-	-	-	979 44
Warwick,	-	165 89	-	-	-	182 51
Watertown,	-	5,000 00	-	-	-	5,000 00
Wayland,	710 93*	1,270 83	1,514 16	1,205 00	243 33*	1,214 60
Webster,	-	3,482 36	-	-	-	2,851 88
Wellesley,	370 11	5,000 00	4,624 98	1,351 45	-*	5,000 00
Wellfleet,	-	407 46	-	-	-	352 84
Wenham,	987 04*	1,051 16	1,384 69	610 81	-*	1,064 16
West Boylston,	-	378 60	-	-	-	380 42
West Bridgewater,	-*	613 84	1,181 69	378 82	567 85*	621 62
West Newbury,	1,019 34*	423 04	1,375 24	385 85	952 20*	436 80
Westborough,	-*	1,293 07	1,488 64	107 75	-*	1,309 46
Westford,	1,429 95*	859 24	1,842 79	537 00	983 55*	882 21
Westminster,	130 47*	377 73	987 82	197 03	610 09*	396 36
Weston,	615 46*	3,359 89	5,963 61	3,600 00	982 80*	3,248 27
Westport,	-	883 26	-	-	-	912 68
Westwood,	-*	1,641 04	-	-	-	1,640 03
Weymouth,	8 99	3,982 86	4,290 61	1,987 02	-*	4,587 23
Whitman,	-	2,215 37	-	-	-	2,229 69
Wilbraham,	-	471 26	-	-	-*	489 82
Wilmington,	2,062 16*	683 73	2,970 17	894 72	1,686 44*	726 89
Winchendon,	-	1,683 77	1,831 59	204 11	147 82*	1,720 71
Winchester,	-*	5,000 00	3,746 79	-	-	5,000 00
Winthrop,	-	5,000 00	-	-	-	5,000 00
Woburn,	3,025 92	4,660 11	9,550 55	2,069 28	4,628 61*	4,828 12
Worcester,	-	5,000 00	-	-	-	5,000 00
Wrentham,	-	560 48	-	-	-	587 68
Yarmouth,	-	989 19	-	-	-	1,020 00

SUMMARY OF RECOMMENDATIONS OF THE STATE FORESTER.

1. That a more pretentious plan for acquisition and management of lands for use as State forests be given due consideration.

2. That legislation be enacted regulating the present slash dangers. Our great losses from forest fires are largely traceable to our indifference in leaving slash where it can be reached by fire.

3. That the appropriation for gypsy and brown-tail moths for the coming year be as follows: \$125,000 for the remainder of this year and \$75,000 for use until the Legislature of 1915 may take action.

4. That the present method of taxing forest land be so altered as to encourage rather than discourage the practice of forestry in this Commonwealth.

Respectfully submitted,

F. W. RANE,

State Forester.



